TIERRA SOLUTIONS, INC.

November 19, 2012

Ms. Amy Legare
National Remedy Review Board Chair
1200 Pennsylvania Ave., NW MC5204P
Washington, DC 20460

Ms. Alice Yeh
Remedial Project Manager
USEP A Region 2
290 Broadway
New York, NY 10007-1866

Re: Tierra Solutions, Inc.'s Comments for Consideration by the National Remedy Review Board Regarding the *Lower Passaic River (Lower Eight Miles) Remedial Investigation and Focused Feasibility Study*

Dear Ms. Legare and Ms. Yeh:

Provided with this letter are Tierra Solutions, Inc's (Tierra's) comments associated with the *Lower Passaic River (Lower Eight Miles) Remedial Investigation and Focused Feasibility Study (FFS)*, which is expected to be released by the United States Environmental Protection Agency (USEPA; Region 2) in the first quarter of 2013. It is our understanding that the National Remedy Review Board (NRRB) will convene next month to discuss this important study, and we appreciate the opportunity to communicate our thoughts early in the evaluation process.

As you will note, the attached document includes four sections: (1) Executive Summary; (2) Summary of Discussion Topics; (3) Overview Comments and (4) Technical Comments. The Executive Summary is self-explanatory. The Summary of Discussion Topics presents Tierra's concerns in a concise summary format that can be used by the NRRB as a basis to engage in discussion with Region 2. The Overall Comments pertain primarily to policy and programmatic issues, while the Technical Comments address the *Lower 8 Miles of the Lower Passaic River Remedial Investigation and Focused Feasibility Study Summary for the Community Advisory Group* (herein referred to as the FFS Summary), which Region 2 provided to the Community Advisory Group (CAG) in October 2012.

Overall, Tierra questions the legitimacy and timing of the FFS program, especially considering the magnitude of the remedial actions being proposed by Region 2. The following observations illustrate our concerns:

- The Remedial Investigations (RIs) for both the Lower 17 miles of the Passaic River **and** Newark Bay have yet to be completed. In other words, the two significant water bodies that bound the FFS area are not yet fully understood. Considering the complexity of the Newark Bay Estuary, and the dynamic relationship between the adjoining systems, the scientific justification for such a dramatic action is uncertain, at best.

- Ongoing sources (including, but not limited to, upland discharges, Combined Sewer Overflows, Storm Water Outfalls, and groundwater) have not been characterized and/or considered. The industrialized setting of this portion of the River system strongly suggests that such an omission would undermine any successes that could be achieved through this massive undertaking.

- The risk assessment that purports to justify the FFS is 1) overly generalized, 2) based on incomplete data/information, and 3) neglects the myriad risks from various stressors in the River. In general, it lacks a sincere appraisal of the potential for a sediment management remedy in the lower eight miles of the River to actually reduce potential human health or ecological risks, which is highly unlikely—particularly because the conservative methods used by Region 2 to compute hypothetical risks would actually show risk even at background levels of contamination in this urban system.

- Remedial work is currently being undertaken in the lower 17 miles, work already has been, or that we believe represents, effective "early action" under the larger RI/FS Program. For example, Tierra, on behalf of Occidental Chemical Corporation, recently completed the removal and disposal of 40,000 cubic yards (cy) of highly contaminated material located adjacent to the Diamond Alkali Superfund Site. Additionally, the Cooperating Parties Group (CPG) is currently in the midst of designing a dredge/cap remedy at River Mile 10.9 in an area found to contain high levels of dioxins, PCBs, PAHs, mercury, and other contaminants of concern.

- Considering the urban setting of this area, an undertaking as massive as Region 2's proposal will dramatically (and negatively) affect the local community throughout the projected approximately decade-long construction period. Potential air quality impacts, noise, and street/river congestion will all be extremely important issues for area residents. While we understand some communication has occurred with the local Community Advisory Group (CAG), we do not believe their input has been sufficiently solicited to date.

- Region 2's proposed FFS for the lower eight miles of the LPR is inconsistent with USEPA guidance and may lead to actions that are inconsistent with the National Contingency Plan (NCP) in various aspects such as, for example, the following (among others): Historically, USEPA has used the FFS process where interim remedial actions are necessary or a presumptive remedy is justified. Neither of these circumstances exist to justify the use of an FFS in the lower 8 miles of the Passaic River. Tierra and other Potentially Responsible Parties (PRPs) have already carried out or will soon be implementing response actions to address areas of the most significant environmental concern and an RI/FS is underway and will soon be completed for the entire LPRSA. Further, the remedial alternatives contemplated by Region 2 do not qualify as interim remedial actions because they foreclose reasonable remedies that could be selected at the conclusion of the LPRSA RI/FS.

Thank you for the opportunity to communicate our concerns, and we look forward to further discussion and collaboration regarding this critical issue.

Sincerely,

Tierra Solutions, Inc.

C. Firstenberg

Clifford Firstenberg
Environmental Sciences Manager
On behalf of Occidental Chemical Corporation
(as successor to Diamond Shamrock Chemicals Company)

attachment

Copies:
Mr. Dave Rabbe, Tierra Solutions, Inc.
Mr. Paul Bluestein, Tierra Solutions, Inc.
Ms. Carol Dinkins, V&E

Comments on FFS Summary provided by USEPA
Region 2 (October 11, 2012)
Submitted by Tierra Solutions (November 19, 2012)

Tierra Solutions Inc. (Tierra) thanks the National Remedy Review Board (NRRB) for the opportunity to submit these comments on the USEPA Region 2's (hereinafter referred to as Region 2) Summary document for its focused feasibility study (FFS) for the lower eight miles of the Passaic River. These comments are organized in four parts (1) Executive Summary; (2) Summary of Discussion Topics; (3) Overview Comments and (4) Technical Comments. Following this Executive Summary is a Summary of Discussion Topics, which presents Tierra's concerns in a concise summary format that can be used by the NRRB as a basis to engage in discussion with Region 2.[1] The Overview Comments identify concerns with overall issues associated with the remediation of the lower 8 miles of the lower Passaic River (LPR). The Technical Comments provide discussion on topics associated with the FFS Summary document published by Region 2. Tierra's comments principally address the three core elements Tierra understands will be evaluated in this combined review by the NRRB and the Contaminated Sediments Technical Advisory Group (CSTAG): cost of the remedy, risk, and compliance with USEPA's Principles for Managing Contaminated Sediments Risks at Hazardous Waste Sites, which are set forth in Office of Solid Waste and Emergency Response (OSWER) Directive 9285.6-08.

This executive summary section focuses on the most significant of Tierra's comments, and on the manner in which Region 2's approach to the FFS is fundamentally misguided as a matter of policy and based on an erroneous approach to many scientific issues, and explains how the errors and omissions made in Region 2's analysis all largely serve to bias the process in the direction of large-scale dredging remedies. In such a context, allowing the Remedial Investigation/Feasibility Study (RI/FS) for the LPRSA to run its course <u>before</u> selecting a massive remedy—the typical practice under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), which accords with both USEPA policy and common sense—is the correct approach.

Region 2's FFS, in essence, would pre-judge the remedy for the lower eight miles of the LPRSA <u>before</u> the completion of the in-progress RI/FS. In pursuing a remedy that involves significant dredging in the lower 8 miles of the LPR pursuant to the FFS, Region 2 forecloses other reasonable remedies that could be selected at the conclusion of a robust RI/FS, such as monitored natural recovery. Foregoing adequate scientific review of environmental conditions in the LPRSA before selection and pursuit of such a significant and permanent remedy is inconsistent with the National Contingency Plan (NCP). This rush to remedy selection makes little sense, given the anticipated completion of that RI/FS in the near-term, particularly in the context of "interim" remedies that would take more than a decade to implement. Moreover, there is also an RI/FS being conducted for Newark Bay. The Passaic River flows into Newark Bay and is subjected to tidal fluxes from the Bay that may contribute to environmental baseline conditions in the lower reaches of the Passaic. Because the entire LPRSA and the Newark Bay are an interconnected system, they should be evaluated as such for the purposes of remedy

[1] The Summary of Discussion topics cross references the later-presented Overall and Technical Comments to assist the reader in locating and reviewing material.

selection. A failure to comprehensively address the ecosystem as a whole will undermine the effectiveness of any actions taken to reduce the risks posed by contaminated sediments present in the environment.

Indeed, the overall deficiencies in the FFS process suggest that Region 2's apparent commitment to large-scale remedies—rather than, for example, exploring targeted and iterative approaches that are more consistent with USEPA's principles for managing contaminated sediment sites—appears to have led Region 2 to ignore or neglect critical issues that must be fully considered before selecting any CERCLA remedy. These considerations are even more imperative when dealing with what Region 2 intends to be the largest sediment remedy in USEPA history. While these issues are spelled out in detail in these comments, a few suffice to illustrate the problem: (1) Region 2's FFS relies on incomplete and inadequate modeling work to justify its assertion that legacy sediments are the principal source of contaminants to the lower 8 miles of the LRPSA; (2) Region 2 has, apparently, not yet compared the risks associated with implementing any of the remedies considered in the FFS to the risks it seeks to reduce through those remedies; (3) Region 2 understates the importance of ongoing sources to the LPRSA, raising the risk of recontamination and suggesting that the FFS overstates the benefits of the contemplated remedies; (4) Region 2 radically understates the costs associated with dredging, which distorts the analysis of the costs and benefits of the remedial options under consideration; (5) deficiencies in USEPA's risk assessment—most importantly Region 2's disregard of peer-reviewed, site-specific data, and its substitution of unrealistically conservative default values—suggests that the FFS will not be based on defensible science. These concerns are particularly salient given the near-term completion of an RI/FS that will substantially reduce the uncertainty surrounding these and other questions.

Region 2's flawed and premature approach creates a substantial risk that any remedy selected through the abbreviated and less-thorough FFS process would be unjustified, unsuccessful, and, in the worst case, counterproductive. Allowing the RI/FS to proceed to its conclusion before selecting a remedy would eliminate or greatly reduce this risk. Most significantly, environmental data demonstrate that portions of the LPRSA upriver of the lower eight miles addressed in the FFS have sediment contamination that is comparable to that found in the FFS study area and are net contributors of sediments to the lower eight miles. Any removal action targeting the lower 8 miles of the Passaic before upstream contaminated sediments are addressed, and additional sources of hazardous substances such as the upper Passaic River above Dundee Dam, Combined Sewer Overflows (CSOs) and Newark Bay are mitigated, will be undermined by subsequent recontamination.

In suggesting that USEPA allow the RI/FS to proceed to completion before selecting a remedy for the lower 8 miles, Tierra is not advocating for a no action approach. To the contrary, several large-scale removal actions are already underway to address the areas of most significant concern in the River. Tierra has completed Phase I of a removal action that removed 40,000 cubic yards (cy) of contaminated sediment and is currently working with Region 2 on Phase II of this removal action, which will remove an additional 160,000 cy of sediment. This removal action will address some of the most concentrated inventory of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and other hazardous substances in the LPRSA. In addition, other PRPs are in the process of designing a removal action to address an area of significant contamination located at River Mile (RM) 10.9. Because these actions are already underway, the use of an FFS to pursue an "interim" remedy is not well founded. Rather, allowing these actions to proceed to completion and then be evaluated is precisely the type of adaptive management/iterative approach that EUSPA's policy calls for, a policy that Region 2 appears to accord no weight at this particular site.

Unlike the targeted actions that are currently underway, the remedial alternatives in the FFS contemplate an enormous removal action that appears to be more akin to a final remedy. Conducting a removal action of such significant scope without the benefit of the technical analyses being performed as part of the RI/FS creates substantial risks that the costly removal action will fail to accomplish its risk reduction objectives. Much information that will contribute to the assessment of environmental risk in the final RI/FS is still being collected. In addition, the FFS Summary document does not provide a sufficient basis to understand the risk analyses that Region 2 has performed, and Region 2's 2007 draft of the FFS and the current lack of full information on the LPRSA provide reasons to believe that the risk assessment may be both incomplete and inadequate. Region 2's insistence on proceeding with action under the FFS at a time when many key areas of data collection in the LPRSA are incomplete increases the likelihood that actions taken under the FFS will be inconsistent with the final remedy selected at the end of the RI/FS process. Thus, Region 2's decision to proceed under the FFS is inconsistent with the NCP.

Based on the limited information available in the FFS Summary, Tierra believes that Region 2's decision to proceed under the FFS is also inconsistent with USEPA's Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites. As discussed above, the FFS fails to address the principle of source control (Principle 1) because it ignores inputs of contaminants of concern from areas outside of the lower 8 miles of the Passaic. Region 2's characterization of the proposed FFS remedies as themselves being "source control" flies in the face of this guidance. The FFS violates Principle 5 because it fails to consider the system as a whole and adopt an iterative, risk-based approach to cleanup. Further the information provided in the FFS Summary makes it impossible to determine whether Region 2's actions are consistent with Principle 2, relating to community involvement, and Principle 3, requiring coordination with state and local governments as well as tribes and natural resource trustees.

The removal actions contemplated under the FFS are extraordinarily costly, and it appears that Region 2 has underestimated the associated costs. The FFS Summary suggests that Region 2 estimates removal costs to be either $350 or $440 per cy of sediment removed, depending on the alternative selected. However, on-the-ground experience demonstrates that these cost estimates are likely to be unrealistic. GE's removal action for polychlorinated biphenyls PCBs in the Hudson River had an average cost of $1,900/cy and Tierra's Phase I removal action in the Passaic cost $2,000/cy. It is not apparent that Region 2 has given serious consideration to the many difficulties and significant costs associated with environmental dredging or rigorously evaluated alternative remedies including monitored natural recovery. Neither is it clear that Region 2's assessment of risks includes the risks posed by the implementation of a dredging remedy, which can be significant in the short term.

Furthermore, the FFS contemplates a sediment removal action on a scale never before considered or observed. While the FFS does present confined aquatic disposal (CAD) as an option for dredged material management, two of the three options considered to deal with dredged material require offsite transportation and upland disposal. Given the scale of the removal contemplated, it is not clear that Region 2 has evaluated the costs and difficulties that would be associated with transporting dredged material long distances for upland disposal. If implementation of a large-scale dredging remedy is to be feasible along a highly urbanized waterway such as the Passaic, it is imperative that Region 2 give serious consideration to both CAD and confined near-shore disposal—Region 2's failure to consider the use of a near-shore confined disposal facility (CDF) is particularly indefensible given that Region 2 itself has endorsed such a remedy in the Administrative Order on Consent governing Phase II of the Tierra removal action—as these likely present the only feasible means of dealing with such a significant quantity of sediment.

These complexities in the lower Passaic River lead to the conclusion that Region 2's use of an FFS is inconsistent with USEPA practices and policies and, ultimately, would be inconsistent with the NCP. The FFS process has historically been used to implement interim remedies or at sites where few technical issues remain because a presumptive remedy is appropriate or extensive sampling and analysis has been conducted on a similar Operable Unit (OU) at the same Superfund site. None of these conditions is present to justify Region 2's use of an FFS in the lower Passaic River. The Passaic is a manifestly complex system and significant technical issues remain to be resolved in the ongoing RI/FS process. As a result, a presumptive remedy is not called for.

In conclusion, Tierra wishes to underscore four major themes that underlie the specific technical comments set forth in the remainder of this document. These themes are as follows:

1. <u>The FFS is premature</u>: At this time, remedial investigation/feasibility study (RI/FS) processes are underway for both the entire 17 miles of the Lower Passaic River Study Area (LPRSA) and Newark Bay. Region 2's FFS focuses on the lower 8 miles of the Passaic River, without regard to the RI/FS processes that address both upstream (LPRSA) and downstream (Newark Bay) segments of the ecosystem. If Region 2 wishes to develop an effective long-term remedy for the entire LPRSA/Newark Bay ecosystem, it is essential that the system be considered as a whole. Therefore, the FFS and any further actions in the lower 8 miles of the Passaic River should await a more complete characterization of the ecosystem, after which remedy selection can proceed to produce an effective long-term solution for the ecosystem as a whole.

2. <u>The FFS is inconsistent with USEPA guidance and past practice and may lead to actions that are inconsistent with the NCP</u>: Historically, USEPA has used the FFS process where interim remedial actions are necessary or a presumptive remedy is justified. Neither of these circumstances exist to justify the use of an FFS in the lower 8 miles of the Passaic River. Tierra and other Potentially Responsible Parties (PRPs) have already carried out or will soon be executing response actions to address areas of most significant environmental concern and an RI/FS is underway and will soon be completed for the entire LPRSA. Further, the remedial alternatives contemplated by Region 2 do not qualify as interim remedial actions because they foreclose reasonable remedies that could be selected at the conclusion of the LPRSA RI/FS.

3. The proposed FFS remedy is unprecedented in size, has significant costs and, in fact, underestimates costs: Based on the summary of the FFS available for review, it appears that USEPA's preferred remedial alternative could cost in excess of $3 billion dollars. The remedy contemplated by the FFS involves remedial dredging on a scale that has never been attempted, let alone observed, to date. The enormity and complexity of the project will result in unanticipated and likely significant costs not yet identified by Region 2, and even leaving the unknowns aside, Region 2 also has substantially underestimated the total costs of such a large undertaking based on recent past precedents.

4. The FFS cannot be justified by current risks: Tierra, on behalf of Occidental,[2] and other PRPs have already taken actions that are addressing the areas of greatest concern from an environmental risk perspective. Data collected throughout the RI/FS process for the LPRSA suggest that the remedial alternatives evaluated in the FFS cannot be justified considering environmental risks that will persist when the Phase II and RM 10.9 interim actions are complete. In order to justify its desired dredging remedy, Region 2 has magnified the potential risks by ignoring site-specific exposure data and requiring the "correction" of observed environmental concentrations of polychlorinated dibenzo-p-dioxin/polychbrinated dibenzofurans (PCDD/Fs) it arbitrarily speculated to be too low.

Summary/Discussion Topics

Critical concerns associated with Region 2's interpretation of the appropriate methods and alternatives for remediating the lower 8 miles of the LPR are presented in this section in a summary format. A detailed discussion of each of these issues can be found in the Overview or Technical Comments sections noted in parentheses. If there is no cross reference to specific discussions, the point is made throughout the document and there is no single section to which to refer the reader for more detailed information.

Region 2's Reliance on an FFS for the lower eight miles of the Passaic is inconsistent with USEPA Practice and the NCP. (Overview Comment 1)

Tierra encourages the NRRB to consider the following concerns regarding consistency of Region 2's FFS with the RI/FS process and the NCP:

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[2] All remedial actions required of Occidental have been performed by either Maxus or Tierra. Occidental is a legal successor to Diamond Shamrock Chemical Company ("DSCC") by reason of the statutory merger into it of an affiliate company that had acquired 100% of the stock of DSCC from Maxus by virtue of a 1986 Stock Purchase Agreement ("SPA"). The SPA requires Maxus to indemnify Occidental for all environmental liabilities related to the Lister Site.

- An FFS is typically generated for interim remedies, presumptive remedies, or subsequent OUs at the same site. None of these conditions is present to justify proceeding under an FFS.

- The complex nature of the lower eight miles of the Passaic suggests it is not suited to a presumptive remedy and removal actions addressing the areas of greatest concern are under way or being designed.

- Significant technical questions about the dynamics of the system remain. Proceeding under the FFS before complete information is available from the RI/FS could lead to actions that are inconsistent with the final remedy.

- The dredging and dredging/capping contemplated under the FFS foreclose reasonable remedies that could be selected after completion of the LPRSA RI/FS. The FFS therefore does not qualify as an interim remedy and is inconsistent with the NCP.

The FFS Deviates from USEPA's 11 Guiding Principles (Overview Comment 5)

The NRRB should specifically consider the following concerns with Region 2's deviation from the USEPA's 11 Guiding Principles:

- Given the history and setting of this river system, Region 2 should account for ongoing inputs of contamination to the lower 8 miles of the LPR, especially considering the Constituents of Concern (COCs) expected to continue to flow over Dundee Dam. (Overview Comment 5.1, Overview Comment 4)

- Considering the very long duration of the proposed project, it is unlikely that Region 2 has adequately briefed the local community on the impacts that such profound remedial action will have on the everyday lives of citizens. (Overview Comment 5.2)

- Significant coordination with state and local governments will be necessary to successfully implement a large-scale removal, such as that contemplated by the FFS. It is not apparent that Region 2 has engaged the state and local governments that will be impacted by the FFS, which could cause delays and increase costs. (Overview Comment 5.3)

- This river system is ideally suited for an iterative remedial approach, given its complex nature and surrounding systems that are equally complex. Also, the ongoing work completed and/or planned for the River (Phase I/II near Diamond Alkali, RM 10.9) serves as a suitable first step (which should then be followed by completion of the RI/FS). (Overview Comment 5.4)

Publication of the FFS is Premature

The NRRB should consider the following conditions as evidence that the FFS is not ready for publication:

- RI/FSs in Newark Bay and the lower 17 miles of the LPR are still under development, and the Lower Passaic River RI/FS is nearing completion.

- Characterization/Control of ongoing sources of contamination is currently inadequate. (Overview Comment 4)

CAD/CDF for Dredged Material Management (Technical Comment 1)

The NRRB should consider the following points related to the use of CADs and CDFs for management of dredged material from the lower 8-mile study area:

- CADs and CDFs are a proven, reliable alternative to upland disposal for contaminated sediment.

- The impacts and risks to the environment and surrounding community are likely to be much lower with a CAD or CDF compared to other disposal options. (Technical Comments 1.2, 1.3)

- The NRRB should strongly endorse the use of a CAD to manage the dredged materials associated with any remedy selected.

- The NRRB should ask Region 2 to also consider other types of CDFs as cost-effective elements of a potential remedy. (Technical Comment 1.2)

Human Health Risk Assessment (Technical Comment 2)

The NRRB panel should ask Region 2 about the following concerns with respect to the HHRA:

- Examine whether risk and hazard estimates for dioxin-like (DL)-PCBs were accounted for separately from Aroclors or total PCBs (i.e., were they appropriately calculated) in Region 2's LPR FFS HHRA per USEPA Guidance (USEPA 2010b). (Technical Comment 2.1)

- Determine whether Region 2 analyzed TEQ sensitivity per USEPA guidance to appropriately characterize the impact of the variability in the underlying TEF data for each congener on TEQ-based risk and hazard estimates. (Technical Comment 2.2)

- Determine whether Region 2 discussed the uncertainties associated with the TCDD reference dose (RfD). Additionally, the NRRB panel should ask Region 2 if it assumed that TCDD acted via a mutagenic mode of action. Region 2 should evaluate how this impacts risk estimates. (Technical Comment 2.3)

- Examine whether any exposure parameter values were derived from site-specific data incorporated into the recent Region 2 LPR FFS HHRA, or if default values were used. If default values were used, Region 2 should be asked to explain why. (Technical Comments 2.5 – 2.7)

- Determine whether Region 2 estimated risks for direct contact exposures to LPR sediment. If so, identify which COCs were the primary risk contributors. If not, evaluate their reasoning for ignoring such a scenario when it is clearly a concern at RM 10.9, and is likely a concern at other areas of the LPR where sediment is exposed. (Technical Comments 2.6, 2.7)

- Determine whether Region 2 used non-peer-reviewed fish ingestion rates in the HHRA. If so, determine whether this comports with USEPA guidance.

- Determine whether the proposed remedy will cause fish tissue concentrations of chemicals to be reduced such that the cancer and non-cancer risks fall into the acceptable range (e.g., cancer risk less than 10^{-4} and Hazard Index (HI) ≤ 1).

- Determine the conclusion of the HHRA if Region 2 had used site-specific exposure assumptions, used an appropriate RfD, and assumed that TCDD acted via a non-mutagenic mode of action. Evaluate whether an early response action would still be warranted.

Ecological Risk Assessment (Technical Comment 3)

The NRRB should consider the following actions related to the ecological risk assessment:

- All adverse ecological impacts, including the relative risk of chemicals, must be factored into the ecological risk assessment.

- Recontamination potential must be considered. (Technical Comment 3.2)

- Acceptable risk levels for the lower 8-mile study area must be clearly defined.

- The ability of the proposed alternatives to achieve acceptable risk levels needs to be clearly demonstrated.

- Risks created by implementation of the remedy itself should be considered. (Technical Comment 3.3)

Datasets Used in the RI (Technical Comment 5)

The NRRB should be aware of the following issues related to the datasets used in the RI:

- The datasets used to develop the FFS are incomplete. Critical ongoing studies in the lower 8-mile study area should be included; data being collected or planned to be collected from the upper 9.4 miles of the LPR and Newark Bay will help to inform any remedy in the lower 8 miles. (Technical Comment 5.1)

- Data processing methodology should be provided in full detail for a dataset to be considered useable. (Technical Comment 5.2)

- Datasets should exclude any data derived at the site of, and prior to, removal actions that have been completed, specifically, the LPR Phase I Removal Action completed in 2012. (Technical Comment 5.3)

Contaminant Fate and Transport (Technical Comment 7)

The NRRB should consider the following points with regard to the contaminant fate and transport analysis:

- Determine whether the EMB model is a reliable tool for understanding the nature of contamination and designing remedy alternatives given that it does not account for all sources but relies on estimates of loadings from only those sources specifically identified. (Technical Comment 7.2)

- Examine the reason for excluding the reach between RMs 8 through 17.4 in Region 2's assertion that the largest source of several contaminants is "Lower Passaic River resuspension." Further, this reach is also not addressed in the proposed remedial alternatives. The analysis needs to separate "Lower Passaic River resuspension" into RMs 0 through 8 and RMs 8 through 17.4 portions to properly evaluate the proposed remedial alternatives for RMs 0 through 8. (Technical Comment 7.2)

- Examine the potential for re-contamination in the FFS Study Area from Upper Passaic River loadings of solids and contaminants, given that Region 2's analysis shows that the Upper Passaic River is a significant source of solids (32 percent) and contaminants such as benzo(a)pyrene (53 percent), fluoranthene (47 percent), and chlordane (32 percent) to the FFS Study Area.

- Examine the technical validity of the EMB model analysis with respect to the following key issues: Do the sources of solids and contaminants in the FFS study area (RMs 0 through 8) include solids from RMs 8 through 17.4 of the LPR? Are the selected data representative, such as whether the presence or absence of Be-7 can reliably identify "recently-deposited" sediment? Are the estimates of solids and contaminant transport in the EMB model analysis consistent with those of the mechanistic model?

Sediment and Contaminant Transport Mechanistic Modeling (Technical Comment 8)

The NRRB should consider the following points with regard to the mechanistic modeling:

- Determine the status of the mechanistic models currently being developed by Region 2 and the CPG, including the level of effort required to fully develop the models. Further, determine how the models will be used to develop and evaluate the proposed remedial alternatives. (Overview Comment 3)

- Examine the consistency between the mechanistic models currently being developed in parallel by Region 2 and the CPG. (Overview Comment 3)

- Determine whether the understanding of sediment and contaminant transport and effectiveness of remedial alternatives is being evaluated with the mechanistic model rather than the cruder EMB model. (Technical Comment 7)

- Determine which datasets were used to develop the models, because the FFS Summary is unclear whether the system conditions were represented by the models using recent data or historical data. Model inputs/datasets should be described in detail, model boundaries and forcing functions should be presented in detail, and model calibration and verification information should be presented.

- Determine whether the model took into account the sediment conditions after completion of the LPR Phase I Removal Action. (Technical Comment 5)

- Determine whether the model represents conditions in Newark Bay after the Harbor Deepening Project work was completed. These conditions may have impacted the salt-wedge transport into the Passaic River. (Technical Comment 8.6)

Remedial Alternatives (Overview Comment 7, Technical Comment 11)

The following should be considered with regard to the identification and selection of remedial alternatives:

- For the size and complexity of the lower 8-mile study area, the FFS Summary presents overly simplistic remedial alternatives that will likely not achieve risk reduction. While a more robust FFS is expected to be released in 2013, the information available for the NRRB review and for comments by concerned parties is insufficient to understand the risk reduction potential of the remedial alternatives Region 2 is considering.

- An alternative that includes Monitored Natural recovery (MNR) (or Enhanced MNR; EMNR) as a true remedial technology should be developed. This can clarify that, compared to MNR or EMNR, full bank-to-bank dredging and dredging/capping remedies are unreasonably costly when compared to the relatively small acceleration of the time to meet remediation goals. (Overview Comment 7, Technical Comment 11.1)

- The FFS should consider risk as a function of time for each of the remedial alternatives presented, given that dredging could result in increased surface sediment concentrations during implementation as compared to less intrusive alternatives.

- It is unclear whether the costs and schedule have taken into account all of the challenges inherent with conducting a large-scale sediment remediation project, and if they have not, they may be significantly underestimated.

Mechanistic Modeling (Technical Comment 8)

The NRRB panel should ask Region 2 about the following with respect to mechanistic modeling to evaluate alternatives:

- Determine the status of the mechanistic model(s) being developed by Region 2 and the CPG, with the objective of developing an effective, consistent tool that can be used to evaluate the remedial alternatives for the lower 8-mile study area.

General Comments

1. The Use of an FFS for Remedy Determination for the Lower 8 Miles of the Lower Passaic River is Inconsistent with the National Contingency Plan and Should be Rejected.

An FFS is a tool used by USEPA to expedite CERCLA cleanups when only a limited evaluation of a site is needed, where the site characteristics permit application of a presumptive remedy or where an interim action will reduce short-term risks while an RI/FS is ongoing in a manner that does not foreclose any reasonable remedy that may be selected at the end of the RI/FS process. As explained in more detail below, FFSs have generally been used in limited circumstances where there are few technical issues surrounding a remedial action or to implement interim remedies while a detailed environmental investigation is completed. Such circumstances do not, however, exist in the LPRSA, where there are many complex scientific issues that are not yet fully understood and where the implementation of any remedy would involve complex trade-offs between risks and benefits. Indeed, just the scale of the remedial alternatives considered in the FFS—some combination of dredging or capping 8 miles of river, at a cost of $3 billion or more, to be implemented over the course of many years— demonstrates that these remedies should be evaluated and selected through CERCLA's well-established RI/FS process, rather than characterized as an "interim remedy" and subject only to an abbreviated FFS process. The scale of the remedial alternatives being considered by Region 2 goes far beyond anything ever developed through an FFS process. If implemented, any of these alternatives would constitute one of the largest, if not the largest, sediment remedy ever selected by USEPA. Region 2's proposed course thus reflects a misuse of the FFS process, which was conceived and intended for truly focused work, not to prematurely select a final remedy for eight miles of a complex, urban river. This is especially so because a RI/FS will, in fact, soon be completed for the LPRSA.

There is no precedent for Region 2's decision to proceed with an FFS for the lower eight miles of the Passaic, particularly while an RI/FS for the entire LPRSA is underway. Rather, the use of an FFS in the lower Passaic is inconsistent with USEPA's policy and practice, and would call the NCP consistency of the LPRSA cleanup into question. As explained below, the FFS is a tool of USEPA's invention that is not governed by the NCP. Region 2's use of an FFS in the lower eight miles of the Passaic displaces the RI/FS in an attempt to advance Region 2's preferred remedy of bank-to-bank dredging or capping without thorough consideration of the data being collected in the ongoing RI/FS—which might well support more limited remedial action—thereby circumventing the requirements of the NCP. Importantly, major portions of Region 2's FFS are incomplete, unpublished, unreviewed, and possibly have not even been initiated. This consideration is particularly salient given the uncertainties surrounding the question of how much to dredge and where; what risks will be associated with re-entrainment of contaminated sediment; and the apparent absence of sufficient evaluation of natural attenuation, costs, and disposal option difficulties. Not only is an FFS the wrong process here, it has not even yet been rigorously implemented.

Indeed, nothing about the FFS process suggests it is adequate for the remedies under consideration here. The term "focused feasibility study" is not found in the NCP. The first use of the concept appears to be in USEPA's 1994 Guidance on Accelerating CERCLA Environmental Restoration at Federal Facilities. This guidance memorandum was intended to support the "accelerat[ion] and develop[ment of] streamlined approaches to the cleanup of hazardous waste" at federal facilities (USEPA 2012b) and it encourages the development of presumptive remedies as standardized methods to approach similar or recurring contamination problems. The guidance states that "[f]ollowing site characterization, a focused Feasibility Study (FS) or Engineering Evaluation/Cost Analysis (EE/CA) may be sufficient when employing the presumptive remedy approach." Notably, the USEPA's 1994 Guidance was issued to provide specific guidance for federal facilities as a companion to the earlier OSWER Directive 9203.1-03 for privately owned facilities (USEPA, 1992). This directive mentions neither presumptive remedies nor the use of an FFS.

It does not appear that USEPA has issued any subsequent guidance on why and when it is appropriate to initiate an FFS rather than an FS. However, an evaluation of USEPA practice demonstrates that the use of the FFS process has grown over time to far exceed the limited circumstances outlined in the USEPA's 1994 guidance memorandum—an evolution that the NRRB should closely scrutinize. If an eight-mile capping or dredging remedy can be selected via an FFS process, there is no limit at all on the use of that process, which is contrary to USEPA policy and guidance.

Unlike the extraordinary remedies under consideration in Region 2's FFS, a review of USEPA's practice reveals three primary, far narrower, circumstances in which an FFS has been used:

1. Interim Remedial Actions: FFSs have been used to evaluate alternatives for interim remedial actions in situations where a full remedy will follow. When an FFS is used to implement an interim remedy it is critical that any actions taken under the FFS be consistent with the broader RI/FS. Consistency with the RI/FS means that the FFS does not foreclose any of the remedies that might be selected through the full RI/FS

process. Because the removal action contemplated under Region 2's FFS will foreclose remedies that could be selected through the RI/FS (e.g. monitored natural recovery), it is not consistent with the RI/FS and does not qualify as an interim remedy for which the use of an FFS is merited.

2. Implementation of a Presumptive Remedy: The use of the FFS outlined in the original USEPA guidance memorandum was for the implementation of a presumptive remedy. Presumptive remedies are implemented at sites where there are not significant, site-specific technical issues that require evaluation before implementation of a remedy.

3. Implementation of a Remedy at a Similarly Situated OU within a Larger Site: When significant amounts of data have been obtained and analyzed during previous RIs, Remedial Designs (RDs), or RI/FSs performed at other OUs at a site, an FFS may be used to implement a remedy at a newly-addressed, similarly situated OU. In practice, an FFS will only be used at a later OU when a full RI/FS has already been conducted for the earlier remediated OU.

Each of these applications demonstrates that the FFS can be an important tool to increase efficiency and decrease costs when further data collection and analysis are not required to develop and choose among a set of remedial alternatives. However, this is not the case in the lower eight miles of the Passaic River. At this time, the ongoing RI/FS for the LPRSA has yet to resolve questions regarding the distribution of contaminated sediment, pathways for redistribution of contamination, or the remedial options that will most effectively address the contaminated sediment that is present in the environment. The complexities arising from the variable distribution of contaminated sediment, scope of the LPRSA, and the magnitude of the remedies under consideration all lead to the conclusion that the Lower Passaic River is not the type of site to which a presumptive remedy can be applied.

Furthermore significant technical questions that will influence both the baseline risk assessment and ultimate remedy selection remain to be addressed in the ongoing RI for the LPRSA. Tierra's opposition to the use of an FFS to prematurely select a remedy for the lower eight miles of the LPRSA should not be misconstrued as a call for no action. To the contrary, Tierra and other PRPs will soon be implementing removal actions in the LPRSA, which are truly focused efforts targeting the areas of greatest environmental concern in the LPRSA. Given that the areas of greatest concern are already being addressed and significant technical issues regarding the balance of the LPRSA remain unresolved, it is difficult to see how an FFS could be justified for the lower eight miles of the Passaic River. Any remedy pursued under an FFS is unlikely to be consistent with the RI/FS for the entire LPRSA. The significant removal contemplated by the FFS effectively forecloses a number of reasonable remedies that may be selected through the RI/FS process, including MNR or capping. Because these remedies could not be later pursued if Region 2 proceeds with the contemplated removal action, the removal action will not qualify as an "interim" remedy. Therefore, the decision to proceed with a significant removal action under the FFS before the RI is completed for the entire LPRSA is harmful to the final process and is inconsistent with the NCP and USEPA guidance. In addition, the FFS deprives the PRPs the opportunity to meaningfully participate in the RI/FS process as stated in the RI/FS guidance before selection of significant and costly remedial actions.

Given the scope and magnitude of the remedies being considered, this FFS program should not proceed on its current path. Importantly, the incompleteness or unavailability of key portions of the FFS raises many questions regarding the adequacy of the FFS suggesting that there is substantial risk that, if Region 2 acts on the basis of the abbreviated FFS process, it will select an alternative that will fail, partially or fully, to achieve the desired risk management objectives or which would be inconsistent with the final remedy determined from the full RI/FS. These considerations suggest that that the RI/FS should be allowed to continue on its course. Rather than select a final remedy in the guise of an "interim action" based on an abbreviated process, Region 2 should develop a measured approach based on the full RI/FS, which will allow Region 2 to implement a logical, iterative action plan for the entire 17 miles of the river.

2. The Upper 9 Miles of the River Are Not Yet Characterized, and Interactions with Newark Bay Are Not Sufficiently Understood

Another significant problem with Region 2's approach is that it selects a substantial remedy for the lower eight miles of the LPRSA at a time when multiple conditions that unquestionably have an effect on that area—including nine miles of upstream river, tidally-influenced areas of Newark Bay, and ongoing CSO, storm water outfall (SWO) and tributary inputs—are not fully understood. In the absence of such an understanding, it is premature to rule out more limited remedies as insufficiently protective, as Region 2 purports to have done. In addition, without a more fulsome characterization of the LPRSA and Newark Bay systems there is an insufficient basis to conclude that the extraordinary interim remedies under consideration in the FFS will achieve the risk reductions Region 2 seeks. To address only a fraction of the overall LPRSA for purposes of an interim action makes little or no sense in the context of the larger and more complex estuary.

To date, sampling in the upper 9 miles of the LPRSA has been limited. Completion of the RI/FS for the LPRSA will reveal additional environmentally-relevant information that should be considered in selecting a remedy for the entire Passaic River. Existing data show that surface sediment in the upper 9 miles of the Passaic River is contaminated, as illustrated on Figures 2 through 15 of the FFS Summary. Recognition of this contamination led to the planned Time Critical Removal Action at RM 10.9. Further data collection in the upper 9 miles of the LPRSA could reveal additional hot spots at which interim remedial actions are also justified. Early action in these isolated areas could ameliorate the level of risk in other portions of the River and thus materially affect remedy selection decisions—a possibility that Region 2 would foreclose by prematurely selecting a final remedy in the contemplated FFS. Furthermore, if areas of significant sediment contamination in the upper 9 miles of the LPRSA are not addressed in advance of, or at least along with, the downstream areas, downstream transport of contaminated sediment may undermine the effectiveness of the FFS remedy.

For example, page 5 of the FFS Summary states that "… median surface concentrations in RM2 and RM12 are very similar." Were Region 2 to proceed under the FFS, the sediment of concern at RM2 would be addressed immediately, while those in RM12 would remain in the environment until a final remedy is executed under the RI/FS. If, indeed, it is true that legacy sediments are the principal ongoing source of contamination to the LPRSA—a claim made by Region 2, but for which there is limited supporting information and regarding which there remains substantial uncertainty—the existence of such sediments demonstrate the inevitability of recontamination. Sediment upstream of the FFS Study Area is subjected to the largest source of freshwater flow in the Newark Bay Estuary (average rate of 1,000 cubic feet per second [HydroQual 2006a]). This inflow may drive transport of upstream contaminated sediment into the lower 8 miles. Therefore, significant remediation of a substantial downstream area should not proceed until the input of contaminated sediment from upstream portions of the river are fully characterized and addressed. Otherwise, the substantial expenditure of resources and short-term risks of dredging will yield no real benefit, as these downstream areas will soon be re-contaminated.

Similarly, an RI is currently being conducted for Newark Bay, with additional data collection required by Region 2 to be undertaken in the near future. The data gaps that still exist in Newark Bay (e.g., ecological sampling, physical data to support numerical modeling) could significantly alter many (if not all) of the conclusions set forth in the FFS Summary. This would potentially impact modeling, risk assessments, and/or remedial alternative selection processes, all of which underpin the entire FFS analysis.

3. The Mechanistic Model of the River Is Incomplete

The basis for the FFS rests on Region 2's current understanding of the movement of sediment in the lower eight miles of the Passaic River. The existing information regarding the movement of sediment is far from adequate to justify the remedial alternatives under consideration by Region 2, however, because it is based on the assumed accuracy and adequacy of the modeling work informing Region 2's understanding of sediment dynamics in the LPR. While the details of Region 2's modeling have not been fully disclosed, currently available information suggests that the existing model is inadequate to support the selection of any of the substantial remedies contemplated by the FFS. As described in more detail below, Region 2's modeling is incomplete and the FFS relies on the Empirical Mass Balance (EMB) model which has significant shortcomings (see discussion in Specific Comments Section 7, below).

The FFS Summary stated that Region 2 has developed an LPR-Newark Bay (LPR-NB) mechanistic modeling suite, which quantitatively describes the baseline conditions and predicts the effects of remedial alternatives to support remedy design. The mechanistic modeling suite represents a state-of-the-science understanding of the hydrodynamic, sediment transport, organic carbon and contaminant transport and fate, and bioaccumulation processes. According to the Final Modeling Work Plan (HydroQual 2006a), each of the aforementioned components of the modeling suite will be (1) developed, (2) calibrated, and (3) verified.[3] This description,

[3] "Developed, calibrated, and verified" are three key steps toward having a model that can accurately describe contaminant transport in the LPR under current and post-remedy conditions. Model development involves defining the model coverage area and writing codes that describe the physical and chemical processes. Model calibration makes the model site-specific by adjusting parameters with site-specific data.

however, does not comport with the model's current status. Although Region 2 maintains that the mechanistic modeling suite is completed, there is little evidence that those three key steps have been completed for each component of the modeling suite. To date, Region 2 has only published a draft report for the hydrodynamic component of the model (HydroQual 2006b), and presented interim modeling results at public meetings. The status of the remaining components of the modeling suite (sediment transport, organic carbon and contaminant transport and fate, and bioaccumulation processes), as related to development, calibration, and verification are not known.

Furthermore, the LPR Cooperating Parties Group (CPG) is developing, in parallel to Region 2, a similar mechanistic model, which is critical to ensuring a sufficient scientific understanding of the LPR to justify the selection of particular remedial alternatives and to ensure the effectiveness of those alternatives. At the most recent model collaboration meeting between Region 2 and the CPG, which was held on September 25, 2012, region 2 reported that the calibration or verification elements of the sediment transport and contaminant transport and fate models (i.e., components of the LPR-NB mechanistic model suite) are incomplete, and some of the model components are still under development. The Region 2 and CPG models are intended to be consistent so that there is scientific consensus with respect to the inherent physico-chemical processes, model calibration and verification, and predictive capabilities. Because the development and selection of a remedial alternative depends on model-predicted effectiveness, the incompleteness of Region 2's and CPG's models demonstrates that the FFS is premature. More importantly, the decisions based on the apparently incomplete model may be incorrect, thus leading to selection of an alternative that is either costlier than necessary to achieve the intended goals or may not achieve those goals at all. Acting on the basis of incomplete modeling may thus fail to adequately manage risks, including the risks of the substantial remedial alternatives under consideration.

4. The Risk Assessment Process Is Incomplete

Region 2's proposed FFS is based upon an incomplete risk assessment for the lower 8 miles and no risk assessment at all for the remainder of the river. Page 9 of the FFS Summary states that sediment from the FFS area "… pose unacceptable risks to human health and the environment …", and concludes that remedial action in the lower 8 miles is necessary to reduce risks. This statement is overly generalized, is based on incomplete data, and does not consider the reality of myriad risks from various stressors (physical, chemical, and biological) that impact and constrain the functionality of the Passaic River's ecosystem. Chemical contaminants represent only an incremental portion of the overall risk to human health and the environment in the river, and a realistic appraisal of their risk has yet to be fully developed and appropriately peer-reviewed. Such an assessment should also consider the range of contaminants in the river and the potential risk of each. The FFS and any subsequent

Model verification compares simulations of current and historical conditions with site-specific data to ensure that the model predictions are sufficiently accurate.

remedy should focus on all chemicals that pose risk, not just select groups like dioxins/furans and PCBs, essentially ignoring or trivializing the risks of other contributors.

Conceptual Site Models (CSMs) of the LPR presented in Region 2 and CPG reports and planning documents (e.g., CPG 2009; Battelle 2005) recognize that conditions within the LPR and ongoing inputs of chemical and environmental stressors originating from areas both inside and outside of the LPR need to be taken into account during the risk assessment/management and remedial decision-making processes. However, it is clear that external stressors and sources of contamination have not been fully or credibly factored into Region 2's decision to proceed under the FFS. Rather, it is apparent that the effectiveness of the remedial alternatives evaluated will be undermined by ongoing sources of contamination, including upstream contaminated sediment and CSOs/SWOs. The human and ecological risks of chemical contaminants posed by these sources are similar in magnitude to those from presently in-place surface sediment in the LPR. As such, the risks from chemical contaminants will essentially be the same after any of the remedial alternatives being considered in the FFS are implemented, calling into question the basis for taking such action in the first place.

Although the FFS summary is simply a broad overview of the report to be released in 2013, there is not even a basic discussion of risk management, which is a core purpose of a feasibility study and is mandated by the NCP; it is critical for remedy selection decisions to weigh the level of potential risk of chemical contaminants versus the risk/benefit of the potential remedial alternatives—an issue that appears absent entirely from the FFS summary. The summary also lacks a thorough appraisal of the potential for a sediment management remedy in the lower 8 miles of the Passaic River to actually reduce potential human health or ecological risks, or will materially reduce them beyond what could be accomplished with less intrusive alternatives. This consideration is particularly important because the conservative methods used by Region 2 to compute hypothetical risks would actually show risk even at background levels of contamination in this urban system. If a similarly conservative approach were taken with regard to evaluating the risk associated with the proposed remedial action, we believe it is likely that associated risk would be substantial. It is important for all remedy selection decisions—particularly one involving a complex, large-scale site like the LPRSA—to consistently evaluate the risks and benefits of the remedial alternatives under consideration, as compared to one another and to no action at all, in order to ensure that the approach ultimately chosen both has real benefits and is superior to the other alternatives under consideration. Based on the information available regarding the FFS, Region 2 has yet to perform this crucial analysis.

The bottom line is that nothing in the FFS has, to date, demonstrated that implementation of any of the presented remedies will reduce risks to below background levels in either the upper tidal Passaic River (i.e., above the lower 8 miles), the urbanized non-tidal portion of the river above the Dundee Dam, or the New York/New Jersey Harbor Estuary in general. That, together with the fact that there has not been an adequate assessment of the (likely substantive) impacts of the remedies on the ecosystem, and the enormous costs associated with each remedy, clearly demonstrates that this FFS is premature.

5. The FFS Deviates from USEPA's 11 Guiding Principles

Region 2's apparent approach to the FFS contradicts USEPA guidance relating to the management of contaminated sediment sites. This is true especially in light of USEPA's 2002 OSWER Directive 9285.6-08, which outlines 11 Guiding Principles (11 Principles) necessary for the successful management of sites similar to the LPR.

These principles are critical at any contaminated sediment site, particularly one where the remedies under consideration are so substantial. The Contaminated Sediments Technical Advisory Group (CSTAG) demonstrated the importance of these principles in its comments to Region 2's 2007 version of the FFS, where CSTAG expressly addressed all 11 Principles and demonstrated how that version of Region 2's FFS fell short of adherence to each one. It appears that Region 2's current approach to the FFS retains many of the same deficiencies, and many (if not all) of the comments made 5 years ago by CSTAG (and others) remain pertinent. Tierra's comments focus on the following most critical of these 11 Principles:

- Principle 1: Control Sources Early
- Principle 2: Involve the Community Early and Often
- Principle 3: Coordinate With States, Local Governments, Tribes, and Natural Resource Trustees
- Principle 5: Use an Iterative Approach in a Risk-Based Framework

Each is described in more detail below.

5.1 Principle 1: Control Sources Early

Region 2 has argued that the sediment to be addressed by the FFS is the major source of contamination to the LPR and Newark Bay. An eight-mile bank-to-bank dredge or cap, however, does not constitute "source control" as that term is used in USEPA's principles for managing contaminated sediment. Rather, USEPA's 11 Principles make it clear that "source control" relates to external sources of contamination that impact the area under consideration and states that the FFS does not apply to the principle of source control and instead attempts to justify a premature sediment remedy based on a source of contamination in the lower 8 miles of the Passaic River while ongoing inputs of contaminants to the LPR are ignored or minimized. The predictable result will be recontamination of remediated areas and far less risk reduction than Region 2 claims, if indeed there will be any risk reduction at all. It is possible that proceeding in this manner will provide no measurable increased protection of human health or the environment, and/or waste billions of dollars in an effort that will not meaningfully reduce risk in the LPR, dollars that could be far more effectively used to implement whatever remedy is ultimately selected through the RI/FS process.

While sediment certainly plays a substantial role in the overall system dynamics, many other sources of contaminants exist within the estuary. These sources contribute contaminants that could well negate any positive benefits from the FFS action. Re-contamination of this, or any system undergoing remediation, is a real threat, especially considering the scope and magnitude of the proposed alternatives. In this case, there does not appear to be adequate data to conclude that the re-contamination threat is benign. In fact, Region 2 states on page 6 of the FFS Summary that they performed only a "screening level" assessment of other sources, which is unacceptable for a remediation project of this size, duration, and importance. This reinforces that the RI/FS for the entire lower 17 miles should be allowed to continue in a way that addresses such critical data gaps, *before* the onset of such an unprecedented "early action." Such a result is a simple application of USEPA's own principles for managing contaminated sediment.

As currently constituted, the FFS does not provide a comprehensive picture of how other mechanisms, including tributaries, overland flow, CSOs/SWOs, and groundwater could impact this system. In light of the LPRSA's long and storied history of industrialization and urbanization, which has evolved into the situation faced today (Iannuzzi et al. 2002), it is incumbent upon Region 2 to perform a more rigorous assessment of potential ongoing sources, at least allowing the current RI/FS to finish its course. For example, Tierra (in cooperation with Region 2) will be collecting data from various CSOs/SWOs within the FFS Study Area in the coming months, all of which should be considered in this system-wide assessment. More specifically, the program is anticipated to collect 20 CSO samples from 10 locations (two samples at each location), 20 SWO samples from 10 locations (two samples at each location), and four dry weather flow samples of the influent to the Passaic Valley Sewerage Commission (PVSC) plant. This data collection is anticipated to commence in the winter/spring of 2013.

As a result of "Superstorm Sandy," occurring in Late-October 2012, certain publicly owned treatment works (POTWs) were left without power for upwards of one week. According to media reports PVSC, one of the affected POTWs, discharged on the order of 1.5 to 2.5 billion gallons of raw sewage into the Newark Bay. Further, for a period of time following power restoration, PVSC continued to discharge partially treated sewage into Newark Bay at a rate of approximately 250 million gallons per day. While this magnitude of discharge is not a "normal" occurrence and is the result of an unusual size storm event, PVSC and other POTWs continue to discharge combined sewer overflow on a regular basis under average rainfall conditions. As cited in the PVSC Long Term Control Plan (PVSC 2007), bypasses for all CSOs reported for Newark, Harrison, Kearny and East Newark average about 2.7 billion gallons per year. This annual CSO discharge, along with the emergency bypassing that continues to occur after Hurricane Sandy (or any other emergency bypassing that may occur due to insufficient POTW infrastructure), has a significant impact on the health of the river.

Furthermore, the upper 9 miles of the LPRSA (including areas above Dundee Dam) cannot be ignored as a potential threat to re-contamination of the FFS area. As set forth in the table shown on Page 7 of the FFS Summary, numerous chemicals (including potential risk drivers) will continue to flow into the FFS area following remediation. More than 60 percent of the benzo-a-pyrene mass emanates from beyond the FFS boundaries. Page 11 of the FFS Summary explains that PCBs and polycyclic aromatic hydrocarbons (PAHs) entering the Passaic River from above Dundee Dam will re-contaminate the FFS study area surface sediment. The summary further states that "Natural recovery processes will serve to reduce the degree of contamination associated with these deposited solids …" but does not indicate whether natural recovery will be able to decisively ameliorate the re-contamination. In addition, Region 2 contractor HydroQual stated in the Contaminant Assessment and Reduction Program (CARP) model report (HydroQual 2007) that sediment below Dundee Dam will be re-contaminated with TCDD because of a potential upstream source.

Finally, numerous sites that are currently on the enforcement watch list are located along the Passaic River and should be considered significant current and future threats to the system. One of many such sites is the Riverfront Industrial Park located in Newark, New Jersey (at RM 6.7), which was recently proposed for the National Priorities List (NPL). A spill from the site to the Passaic River prompted this action. Undoubtedly, many other upland sites are also affecting the system, and should be better understood and controlled before significant action is taken in the river.

5.2 Principle 2: Involve the Community Early and Often

As currently proposed, completion of either of the two alternatives being carried forward for detailed evaluation will consume between 6 and 11 years to complete. This assumes that the durations provided in the FFS are accurate, which is almost certainly not the case. Past experience demonstrates that either of these remedial alternatives could take up to twice as long as estimated in the FFS Summary. Regardless of the inaccuracy of the durations set forth in the FFS Summary, this work will have a significant impact on the residents of Newark and surrounding areas for many years. Quality of life issues, such as traffic, noise, odors, and others will all come into play at a magnitude not seen before in this region. While the LPR Phase I Removal Action dredging project (40,000 cy removal effort) was completed with little or no impacts to the surrounding community, the proposed dredging of 4.3 to 9.6 million cy of sediment represents a vastly greater and different effort that may have effects beyond those seen in earlier removal actions.

Accordingly, dealing effectively with the local community, including the Community Advisory Group (CAG) will be critical to the successful execution of any remedial action involving substantial dredging activity. The CAG, composed of local residents, business owners, and regulatory personnel, represents a cross-section of stakeholders, all of whom are extremely interested in the Passaic River's future. Their input and involvement in the LPR Phase I Removal Action proved invaluable and contributed to the overall success of the project. Furthermore, their involvement began very early in the design process. However, the existing CAG does not adequately represent all of the communities that will be affected by the proposed action.

It is not apparent that the elements of the current FFS are being communicated appropriately to the CAG or other potentially affected communities. Public outreach must be planned and executed in a manner proportionate to the project at hand. Actual contact with city and county governments is needed, not just local CAG. This work, regardless of the alternative selected, will have an extremely broad footprint, and will have an immense impact on the day-to-day activities of individuals in the community, what they do, and what they don't do; where they go, and where they don't go; what business they conduct, or what recreational activity they choose to forgo.

It is important to recognize and acknowledge the model set forth by the LPR Phase I Removal Action, but just as important, it needs to be understood that this project will have far more substantial impacts on affected communities, and should, therefore, be coordinated and communicated accordingly. Again, it is not apparent that this is happening today. Waiting until the release of the document in spring 2013 will be too late for meaningful input.

5.3 Principle 3: Coordinate With States, Local Governments, Tribes, and Natural Resource Trustees

The FFS process lacks a formal mechanism for involvement by states, local governments, tribes, and natural resource trustees such as the consultation and commenting that would take place as part of an RI/FS and subsequent remedy selection. Without the safeguards of a formal participatory process, there is a risk that coordination between Region 2 and state and local governments will be insufficient in the planning and design stages, raising the potential for substantial delays and increased costs in the implementation of Region 2's selected remedy. This is another reason that the RI/FS should be the vehicle for remedy selection in the LPRSA. Experience with the LPR Phase I Removal Action suggests that the difficulties of interagency coordination and cooperation are significantly underestimated in the FFS, making additional complexity and delay associated with such coordination a near certainty. Therefore, the issue of interagency coordination and cooperation should be more carefully considered. More importantly, given the magnitude of the decision at hand, actual interagency coordination and cooperation should take place in the context of the RI/FS before Region 2 selects a preferred alternative and not only after such a selection is made public. Details and supporting examples follow.

5.3.1 State Authorities not Sufficiently Involved

Through the application of applicable or relevant and appropriate requirements (ARARs) the CERCLA process calls for incorporation of the substantive requirements of state regulations in remedial activities. While CERCLA exempts PRPs from permitting processes, fulfillment of the substantive requirements of state law can require significant time, energy, and expense. Moreover, what constitutes compliance with substantive requirements can be subject to significant disagreement. The best relevant example is the considerable discussion, debate, and disagreement that took place during the LPR Phase I Removal Action with regard to substantive compliance with state law related to air quality. Late in the design process, the New Jersey Department of Environmental Protection (NJDEP) voiced concern over air quality and odor control issues in the context of substantive compliance with the New Jersey Air Regulations. Their concerns, which included community exposure to toxic constituents, as well as potential community reaction to nuisance odors, resulted in the need for considerable reanalysis of design approach, and ultimately led to the implementation of several design modifications to address state concerns. These modifications included changes to storage tank design and operating approach, as well as implementation of an extensive air quality monitoring program during the removal action. The introduction of these late-stage design and monitoring changes increased removal action costs. This is an important yet unconsidered factor for the FFS alternatives. Due to the much larger scale of the FFS alternatives, should a similar issue arise it could materially alter the cost and benefits of particular remedial actions, both in terms of cost-benefit and in the timing of any risk reduction that is anticipate to occur, as sufficient delays could call the justification of any remedial action into question in the first instance. Moreover, it is also possible that the incremental cost to address design requirements stemming from state law or ARARs will not be uniform from one alternative to another. This could potentially result in decision-altering underestimation of cost, particularly for the alternatives involving more extensive sediment removal. What is even more disconcerting, however, is that, while the LPR Phase I Removal Action ultimately addressed most of the state's concerns regarding air quality, the dredging work contemplated by some of the alternatives listed in the FFS may render compliance impossible, thus threatening the feasibility of any dredging activity For example, the LPR Phase I Removal Action benefitted from being located a considerable distance from air quality receptors. This is not likely to be the case for some of the listed alternatives. In fact, application of some of the air impact models required by the state might result in appreciably higher short-term risk than currently perceived. In addition to air, other state law ARARs relating to land use, tidelands, floodplains, water use, and storm water may have similar implications.

5.3.2 Local Authorities not Sufficiently Involved

As with state authorities, all of the alternatives represented in the FFS will require extraordinarily close coordination with local authorities including municipal and county governments. Although the experience with the LPR Phase I Removal Action was positive with respect to City of Newark and Essex County interactions, the increased scope of the potential alternatives portends a much higher level of interaction on such critical topics as noise, light, hours of operation, traffic, and community exposure during the remedy. The cost, time, and potential complicating factors that might result from these interactions do not appear to have been considered.

5.3.3 Natural Resource Trustees not Sufficiently Involved

Although the Natural Resources Damage Assessment (NRDA) and CERCLA processes are separate, the FFS needs to properly consider how trustee agencies will view damages due to the remedies themselves. It is not clear that this has been considered. In the case of the LPR Phase I Removal Action, underwater sound and possible avian impacts were raised by National Marine Fisheries Service (NMFS) personnel for consideration, and ultimately a bird deterrent system and an underwater sound monitoring program were required. Both caused delays to the design schedule and increased the project's costs.

While there were no adverse impacts during the LPR Phase I Removal Action work, the much more extensive and long-duration remedies proposed in the FFS could elicit extreme responses from resource agencies. We anticipate that the resource agencies will naturally prefer more extensive remedies, but the monitoring requirements need to be better understood and associated costs need to be included in the overall cost estimate for comparison purposes.

5.4 Principle 5: Use an Iterative Approach in a Risk-Based Framework

Selection of a remedy for the lower eight miles of the LPR on the basis of an FFS makes little sense given the impending completion of two separate and independent RIs for the Passaic River and Newark Bay. Rather than allow this well-established and rigorous process to take its course, the FFS appears to have been developed in haste, and will result in a premature remedy to be performed at the cost of billions of dollars and with insufficient assurance that it will result in the predicted risk reduction. In such a case, an iterative remedial process is a more logical approach than prematurely selecting an LPR-wide remedy. Such an iterative approach is endorsed by USEPA in the 11 Principles, and would best serve the needs of the LPR.

Rather than select a massive bank-to-bank dredging or capping remedy now, an iterative approach would initially target particular areas that are suspected to result in significant impacts to the site. This would then be followed up by additional actions (as necessary) as more scientific and engineering data are produced. Region 2's rush to discard this iterative approach is particularly difficult to justify because several short-term actions are currently in progress, and these actions could inform such an iterative approach. Moreover, USEPA has publicly stated (Ells 2011) that the iterative approach is desirable at just this type of site (large segments of water bodies where persistent organic compounds are present).

Specifically, there are ongoing removal actions taking place in the LPR: one is immediately adjacent to the former Diamond Alkali Site, which has removed 40,000 cy of material (including the highest TCDD concentrations in the LPRSA), and will result in the removal of 160,000 cy more. The other is currently under design at RM 10.9. These actions will result in near-term environmental improvements, and the lessons learned from such experiences will prove invaluable as successive projects evolve over time.

Relating back to Principle 1, a more logical process for the LPR would allow the RI/FS to continue and simultaneously seek to control ongoing sources to the system (e.g., upstream of Dundee Dam, CSOs). These, together with implementation of the Phase I and RM 10.9 removal actions, serve as worthy short-term actions for this complex system (in lieu of a potentially $3+ billion action that addresses almost 50 percent of the LPR). Once the RI/FS for the 17-mile stretch is completed, it would make sense to then perform remediation from upstream to downstream, to minimize the chances of post-remedial recontamination, with the selection of a remedy for the lower 8 miles to take into account these conditions.

This iterative approach has been followed at numerous sites, including at New Bedford Harbor and the Hudson River. In each case, valuable lessons were learned along the way, and allowed for more informed decisions to guide subsequent remedial phases.

6. The Costs Cited in the FFS Summary Are Likely Significantly Underestimated

Unit costs for the LPR Phase I Removal Action were approximately $2,000 per cy of material removed.[4] The first phase of the Hudson River dredging project, which removed approximately 290,000 cy of material, had a unit cost of approximately $1,900 per cy (General Electric 2010).[5] The work involved in these two dredging projects is most comparable to the Dredged Material Management Scenario B (Off-site Disposal) for Alternative 2 (Deep Dredging with Backfill) and Alternative 3 (Capping with Dredging for Flooding and Navigation). The costs cited in the FFS Summary for these remedies are $350 per cy and $440 per cy, respectively.

Costs are difficult to compare between projects, because it is recognized that the scope and size of any two projects will not be the same. There may be some economies of scale that can be realized with the large dredging volumes as compared to the two cited projects. Conversely, dredging on the scale contemplated in the FFS will likely have unforeseen challenges that will add to the project's cost. Based on these two as-built comparisons of major dredging projects in the same general area of the country, it is likely that the estimated costs for the alternatives presented in the FFS Summary are significantly underestimated. As discussed further in the Specific Comments, it is likely that the costs do not adequately account for many of the complexities of completing a project of this size. Site unknowns (for example, the number of bulkheads within the lower 8 miles that will require replacement, upgrades or buttressing to complete the work; the presence of submerged utilities that will need to be managed, just to name a few) will quickly escalate unit costs.

7. Region 2 has not adequately considered the ability of dredging to meet risk-based goals or the alternative of monitored natural recovery.

Environmental dredging is a complex and expensive process that does not always meet environmental risk reduction goals. Based on the information provided in the FFS Summary, it is not clear that Region 2 has adequately considered the challenges associated with implementation of environmental dredging or the use of MNR as an alternative.

MNR consists of allowing natural processes to reduce sediment contamination below risk levels. EMNR broadcasts coarse-grained materials over the sediment surface to accelerate the process of natural recovery. USEPA guidance states "[d]ue to the limited number of cleanup methods available for contaminated sediment,

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[4] Unit cost includes pre-construction activities (EE/CA, pre-design investigations, design, and permitting); site preparation; steel sheet pile enclosure; sediment processing and water treatment; dredging and backfilling; transportation, treatment and disposal; and monitoring and oversight.

[5] Unit cost includes design and planning including investigations; construction of the associated facilities; dredging, transport and disposal of the material; and construction management, monitoring, and oversight.

generally, project managers should evaluate each of the three potential remedy approaches (sediment removal, capping, and MNR) at every sediment site. At large or complex sites, project managers have found that alternatives that combine a variety of approaches are frequently cost effective" (USEPA 2005). While MNR is considered as a component of all of the remedial options presented in the FFS, it is not clear that Region 2 considered MNR as a stand-alone remedy that could avoid the challenges posed by environmental dredging.

Specific Comments

1. Confined Aquatic Disposal/Confined Disposal Facilities for Dredged Material Management

If Region 2 selects any remedial action involving the removal of contaminated sediment, the management of dredged materials will be essential to the implementability and cost-effectiveness of such action.

The FFS considers three options for management of dredged materials: CAD, off-site disposal, and decontamination and beneficial reuse. The first alternative (CAD) is as protective as, or more protective than, either off-site disposal or beneficial reuse, and is vastly more implementable and cost-effective. The CAD described in the FFS contemplates the construction of submerged disposal facilities in the bottom of Newark Bay. CADs are but one type of CDF and offer an efficient disposal solution for dredged contaminated sediment. Other types of CDFs include confined nearshore disposal, confined onshore disposal, and island CDFs. Fundamentally, all CDFs function by creating a barrier of steel or earthen materials, disposing of the sediment, and then covering them with an impermeable cap. The principal difference between CADs and other types of CDFs is that CADs are completely submerged, while the surfaces of other CDFs are emergent land.

Both CADs and other types of CDFs have been found to be highly effective for disposing contaminated sediment. USEPA's Sediment Guidance recognizes that a CDF "… can be integrated with site reuse plans to both reduce environmental risk and simultaneously foster redevelopment in urban areas and brownfields sites" (USEPA 2005). It is not clear why Region 2 did not consider a CDF as an approach to managing dredged materials in addition to a CAD. As noted below, Region 2 has already endorsed the use of a nearshore CDF in a CERCLA Administrative Order on Consent for the LPR Phase II Removal Action. The NRRB should recommend consideration of a CAD or CDF alternative in the LPR FFS.

1.1 Both CDFs and CADs are Proven Methods for Dealing with Contaminated Sediment

Generally speaking, CDFs use engineered dikes, berms, or sheet piles to isolate the contaminated sediment from the environment. Once filled, the CDF is capped, and the new land surface thereafter is available to use for other purposes. CADs are a type of CDF, except that the capping takes place below the surface of the water, typically to match the original bathymetry. CADs can be placed in existing natural depressions or can be built by excavating a depression into which the sediment is deposited. CDFs have been extensively used in North America as a remediation technology at contaminated sediment sites. Similarly, CADs have frequently been used to manage contaminated sediment, most notably by the U.S. Army Corps of Engineers (USACE), at sites located in New York; Boston; Los Angeles; Portland; and several others in Massachusetts, Washington, and Puerto Rico (Bailey 2008). These technologies are similar in that they isolate contaminated materials from contact with humans and the environment.

USEPA has successfully used CDFs at a number of Superfund sites, including at the Commencement Bay Superfund Site, and is considering use of a CDF at the Portland Harbor Superfund Site. At the Milwaukee Waterway CDF in Tacoma, Washington, for example, construction was completed in 1995, and follow-up studies have confirmed that contaminants are not leaching from the CDF (Fabian and Spadaro 2006). Similarly, at the Blair Slip 1 nearshore CDF, almost 640,000 cy of sediment contaminated with persistent pollutants, such as PCBs and PAHs, have been disposed pursuant to a USEPA-selected CERCLA remedy. The Blair Slip 1 CDF accepted contaminated dredged material from the Hylebos and Middle Waterways, among other OUs in the Commencement Bay area (USEPA 2010a). Similarly, a CAD was successfully used in a CERCLA remedy involving dredging and confined disposal of PCB- and mercury-contaminated sediment at the Puget Sound Naval Shipyards Complex in Bremerton, Washington. At that site, USEPA Region 10 concluded that use of a CAD "… would provide the same reduction in human health and environmental risk …" as another alternative remedy involving off-site disposal of the same sediment (USEPA 2000). In October 2002, the United States Navy conducted the required 5-year review of this remedy, which concluded that the CAD was "… protective of human health and the environment in the short-term …" and determined that the CAD-based remedy would also be protective in the long term based on the anticipated completion of a comprehensive management plan for the site (USEPA 2002). The second 5-year review in 2007 confirmed that the CAD "… remain[ed] protective of human health and the environment" (Naval Facilities Engineering Command 2007).

USEPA and USACE have issued joint guidance for use in determining whether a CAD or CDF is appropriate at a particular site. Generally, both agencies suggest that parties "… consider the materials['] physical properties, levels of contamination, the quantity of material to be dredged, availability and suitability of disposal sites, as well as economic, social and other factors …" when selecting the most appropriate alternative for managing contaminated dredged material (USACE and USEPA 2003). In its joint guidance, Great Lakes Confined Disposal Facilities, the USACE, and USEPA stated that "… [c]onfined disposal has been, and remains, the most commonly used management alternative for contaminated sediment …" because "… it is the most dependable, cost-effective means available" (USACE and USEPA 2003). USEPA's own guidance document also recognizes the use of CDFs or CADs as a viable method for managing contaminated sediment. The focus of that 2005 guidance document is the use of CADs in cases when neither dredging with land disposal nor capping contaminated sediment in-situ is feasible (USEPA 2005). This is an important consideration given the substantial volume of dredged material associated with the alternatives identified by Region 2 in the FFS.

Finally, it should be noted that Region 2 has already endorsed the use of confined disposal as a remedy for heavily contaminated sediment from the LPR, including sediment that Region 2 has itself described as containing "… extremely high concentrations of 2,3,7,8-tetrachloro-dibenzo-p-diozin" (Basso 2008). In a 2008 Administrative Order on Consent between Occidental Chemical Corporation and Region 2, Region 2 authorized the development of a Non-Time-Critical Removal Action involving heavily contaminated sediment in the LPR, with

Phase II of the Removal Action to involve "… the transport and disposal of [dredged] materials to a Confined Disposal Facility ("CDF") located on-site" (CERCLA Docket No. 02-2008-2020, ¶ 9). Given that Region 2 has already endorsed the use of a CDF for such highly contaminated sediment, there is no technical justification for rejecting the use of a CDF for materials having lower concentrations of TCDD. Accordingly, use of a CAD or CDF is an acceptable approach to managing dredged Passaic River sediment generated by any remedial option selected through the FFS process, and the NRRB should strongly encourage its use here due to the cost-effectiveness and implementability considerations that are well documented and discussed below.

1.2 CAD/CDF-based Approaches are Equally Protective, More Implementable, and Cost-effective than Off-site Disposal

The principal risk identified in the FFS is the resuspension of contaminated legacy sediment. As the FFS Summary explains, the contaminants upon which the FFS focuses are strongly hydrophobic and adsorb strongly to sediment. Accordingly, once this sediment is isolated from the environment, it will pose little further risk; as a result, use of a CDF or CAD would be an effective remedial action.

In the context of sediment remediation, it is critical to consider the net risks presented by various methods of materials handling in order to explicitly identify the risk tradeoffs implicated by various remedial decisions. For example, removal of contaminated sediment from the environment may reduce the environmental risks posed by that sediment to aquatic biota, but if the price of this risk reduction is increased risks in other media (such as those resulting from air emissions from dewatering and materials handling), there may be no net benefit and another action should be chosen. USEPA guidance acknowledges this concept, explaining that "Contaminated Sediments may be handled and rehandled a number of times during the implementation of a remedial alternative. The costs and contaminant losses of each of these handling operations may be significant" (USEPA 1994). Further, "… no remedial alternative for contaminated sediments is without some environmental consequence …" and the "… balancing of environmental benefit vs. cost is a critical part of the evaluation of sediment remedial alternatives" (USEPA 1994). In the case of the off-site disposal alternative, such contaminant losses would include air emissions from dewatering and materials handling, wastewater, and other mechanisms. Given these considerations, a CAD may be the lowest-risk option for dredged material management.

Environmental and human health risk assessment (HHRA) of the CAD cell alternative has shown that it can provide one of the lowest-risk options compared with other alternatives (Kane-Driscoll et al. 2002). Confined disposal is associated with less rehandling of material and fewer contaminant transfer pathways. Upland disposal can result in greater dermal contact, volatile emissions, and groundwater pathways. Upland disposal also increases risks of highway accidents, which can lead to injury and death (Fredette 2009).

Based on the documents that Region 2 has made available to date, it appears that Region 2 has considered only the risk reduction associated with the removal of sediment from the aquatic environment, without also considering the risks that will be created by execution of the remedial action. In addition to the resuspension of contaminated sediment inherent to any dredging activity, the management of dredged materials will itself create some risks, including the potential discharge of contaminants to air or water associated with materials handling and dewatering; worker safety issues associated with these large-scale industrial processes; and the risk of highway or other accidents associated with the movement of such large volumes of material. The NRRB should emphasize to Region 2 that it should not make any remedial decisions until all risks have been properly evaluated in detail, a position consistent with relevant USEPA guidance. When all risks are considered, use of a CAD will be the lowest-risk alternative for managing dredged materials.

CERCLA mandates that the NCP require consideration of cost-effectiveness as one of the balancing criteria for selecting among remedial alternatives that are sufficiently protective (42 U.S.C. §9605[a][7]). In this case, use of a CAD or CDF would be a vastly more cost-effective method to achieve whatever environmental benefits would result from the massive dredging remedial alternative under consideration by Region 2. Cost-effectiveness has been a major factor in selecting a CDF or CAD, rather than off-site disposal, at a number of sediment remediation sites. For example, in determining that the CAD alternative was appropriate at the Puget Sound Naval Shipyard Superfund site, USEPA Region 10 determined that the CAD was the alternative most "… protective of human health and the environment and provide[d] the best overall effectiveness proportional to its cost" (USEPA 2000). In considering the same alternatives at another site, the Minnesota Pollution Control Agency (MPCA) reached the same conclusion in assessing alternatives under the Minnesota Environmental Response and Liability Act (Minn. Stat. §§ 115B.01-115B.24). In selecting between a CAD hybrid approach and one involving dredging and off-site disposal, MPCA found that the CAD alternative "… achieves a comparable or superior degree of long-term effectiveness than other alternatives, and does so at a total cost that is approximately half the cost of the one other alternative that provides comparable long-term effectiveness" (MPCA 2004).

Here, Region 2's own analyses demonstrate the vastly more cost-effective nature of the CAD-based approach. For either of the two active remedial options considered in the FFS, use of a CAD results in a remedial cost that is less than 50 percent of the cost of off-site disposal. Where Region 2 is proposing a dredging remedy of unprecedented scope, cost-effectiveness considerations are even more salient than usual.

1.3 CAD Is the "Green" Option

CAD is not only a proven and effective method for managing contaminated sediment, it is also a more sustainable dredged material management option than either of the other alternatives proposed in the FFS. Disadvantages of dewatering and treatment options include the potential impacts these processes have on the local community while remediation is underway. Air emissions, noise, odors, and vehicular traffic through neighborhoods over extended periods of time are all impacts to be considered when conducting upland processing in highly urbanized areas. The advantage of a CAD is that the material stays in the waterway throughout the process, from the point of dredging, through transport to the disposal site, at offloading, and at final disposal, as opposed to moving through residential and commercial neighborhoods. Barges also have significantly greater carrying capacity per unit. Depending on the size, one barge can carry the equivalent of one to two hundred trucks' worth of material. The CAD is also in close proximity to the work site, as opposed to hundreds or in some cases thousands of miles away, considerably reducing the air emissions and greenhouse gases associated with the transportation of the material. The energy inputs associated with the handling, dewatering, and treatment of the material should also be considered, as these are not necessary for CAD disposal. These considerations are consistent with Region 2's Clean and Green Policy (USEPA 2009), which has the stated goal of "… enhancing the environmental benefit of federal cleanup programs by promoting technologies and practices that are sustainable" (USEPA 2009).

Notwithstanding that one of the alternatives proposed by Region 2 in the FFS is preferable to the others, as stated above, other concerns support overall opposition to any remedial alternative being selected at this time.

2. Human Health Risk Assessment

The FFS Summary does not provide any information on the HHRA conducted by Region 2 as part of its evaluation of remedial alternatives for the lower eight miles of the Passaic River. However, in an earlier 2007 draft of the FFS for the lower eight miles of the Passaic River, Region 2 concluded that PCDD/Fs and PCBs were the primary contributors to human health risks posed by the site. The two risks specifically noted by Region 2 were excess cancer risk and non-cancer health hazard based on ingestion of fish and crab caught in the lower Passaic River. While Tierra has not had the benefit of reviewing any information regarding the HHRA underlying the current FFS, Tierra assumes that Region 2 remains concerned with these same risks.

Tierra's concerns about the adequacy of Region 2's HHRA fall into three primary categories, which are summarized here and set forth in more detail in the sections that follow

1. <u>Failure to conduct a complete risk assessment that thoroughly evaluates the contributions of COCs to human health risk in the LPR.</u>

    a. It is not clear how Region 2 calculated PCB health risks. If Region 2 relied solely on a method that examines the total dose of PCBs without special consideration of the dose of DL-PCBs, the contribution of PCBs to human health risk may be underestimated (Section 2.1).

    b. It is not clear if Region 2 conducted a toxicity equivalency factor (TEF) sensitivity analysis, meaning that it may not have fully evaluated the range of potential risks posed by various PCDD/F and DL-PCB congeners.

    c. The data underlying USEPA's new non-cancer RfD for TCDD is highly questionable and Region 2's estimate of non-cancer risk may be overstated if it relied on this RfD (Section 2.3).

    d. It appears Region 2 may have employed cancer slope factors that overstate the human health risks resulting from exposure to PCDD/Fs (Section 2.4).

    e. It does not appear that Region 2 has accounted for other dioxin-like compounds, which data suggest may be present (Section 2.10).

2. Failure to consider site-specific data that suggest actual human health risks are much lower than Region 2 asserts.

   a. Region 2 has refused to consider site-specific evaluations of fish consumption in the LPR that suggest much lower exposures than the USEPA default values it relies on (Section 2.5).

      b. Region 2 does not appear to have evaluated all exposure routes, potentially generating health risks posed by COCs in the LPR that are not accurate (Section 2.6).

   b. Region 2 failed to account for the small fraction of the local population that is actually exposed to COCs in the LPR; this calls into question the human health benefit of the proposed, very costly remedy (Section 2.7).

3. Failure to assess whether proposed remedial alternatives will achieve the risk reduction goals set forth in the FFS.

Collectively, this suggests that a more thorough HHRA, prepared in accordance with standard USEPA Risk Assessment procedures and with public review, is necessary before selecting a large and complex remedial action for the LPR.

2.1 Appropriately Calculating PCB Cancer Risk and Non-Cancer Hazard Estimates

It is not clear if Region 2 assessed the risks posed by PCBs using just total PCBs or if it assessed DL-PCBs separately. If Region 2 failed to address DL-PCBs separately, the resulting LPR FFS cancer risk and hazard index values are inaccurate and will not comply with USEPA guidance documents. It also follows that any remedial alternatives under the FFS that are based on risk and hazard estimates that do not appropriately account for DL-PCBs may fail to reduce human health risk in the LPR and ultimately be inconsistent with a remedy selected through the RI/FS process.

USEPA has historically employed a variety of methods for calculating PCB risk (e.g., based on Aroclor mixture profile concentrations, summing total PCB congeners, treating DL-PCBs and non-DL-PCBs separately). However, it is now well established, that a subset of PCB congeners elicits aryl hydrocarbon receptor- (AhR-) mediated biochemical and toxic responses similar to PCDD/Fs, observations that have been made in both *in vitro* and *in vivo* test models. Thus, assessing dioxin-like and non-dioxin like PCBs separately in a risk assessment is simply the correct procedure – to not do so would be inconsistent with standard risk and regulatory guidance. To address the risks posed by PCBs eliciting dioxin-like biochemical and toxic responses, the World Health Organization (WHO) established Toxicity Equivalency Factors (TEFs) for 12 DL-PCB congeners based on studies that examined their potency relative to TCDD. The most current TEFs include 12 DL-PCB congeners, with TEF values established by an expert panel consensus and published in the peer-reviewed literature (van den Berg et al. 2006).

Importantly, the health risks posed by DL-PCB congeners are not fully captured when using the Aroclor cancer slope factor (CSF) and RfD. Using just the Aroclor CSF and RfD for PCB mixtures likely underestimates the risk posed by DL-PCBs for several reasons including: (1) the CSF and RfD values for PCBs are based on toxicity studies that used PCB technical mixtures (Aroclor) and not on the dose of the DL-PCBs within the Aroclor mixtures and (2) the proportion of the DL-PCB congeners in the commercial Aroclor mixtures is not representative of what is found in the environment. This concept is well recognized and *not* addressing the DL-PCB component would be inconsistent with standard regulatory practice. As noted on the USEPA IRIS page for PCBs, "When congener concentrations are available, the slope-factor approach can be supplemented by analysis of dioxin TEQs to evaluate dioxin-like toxicity. Risks from dioxin-like congeners (evaluated using dioxin TEQs) would be added to risks from the rest of the mixture (evaluated using slope factors applied to total PCBs reduced by the amount of dioxin-like congeners)." USEPA then presents sample calculations for doing so in their guidance document on PCBs (USEPA 1996). Finally, recent guidance issued by the USEPA specifies that the 2006 WHO TEF scheme should be used for evaluating the human health risks from exposures to environmental media containing PCDD/Fs and DL-PCBs (USEPA 2010b).

2.2 Importance of TEF Sensitivity Analysis

The USEPA recommends that, for major risk assessments, a sensitivity analysis should be conducted to illustrate the impact the TEFs have on the toxicity equivalent (TEQ) value, which is consistent with good risk assessment practices (USEPA 2010b). The USEPA states that the TEF sensitivity analysis will help: (1) to characterize plausible upper and lower estimates of the TEQ concentration in order to assess the potential range of the TEQ concentration (which directly impacts risk estimates); and (2) to identify the influence of TEF values for specific compounds on the TEQ concentration. The USEPA recognizes that insightful sensitivity analyses can be conducted using upper and lower bounds for TEF values (as provided in the 2010 USEPA TEF Guidance), and that the benefits associated with such analysis outweigh the limitations (USEPA 2010b). It is not clear whether Region 2 followed this recommendation for the current LPR FFS HHRA.

2.3 Non-Cancer RfD Shortcomings

Region 2 stated that non-cancer health hazards were "much higher" than acceptable levels based on fish and crab ingestion as estimated in its most current LPR FFS HHRA. The USEPA finalized a non-cancer RfD for TCDD earlier this year, so it is expected that Region 2 calculated non-cancer hazard based on health estimates that incorporated this new toxicity factor. However, the relevance of the study data on which the new RfD is based is highly questionable.

The USEPA derived the new non-cancer RfD of 0.7 picograms of TCDD per kilogram of body weight per day (pg TCDD/kg-body weight/day) based on dose-response data presented in two studies that evaluated reproductive and developmental endpoints in subpopulations of the Seveso, Italy cohort (Mocarelli et al. 2008; Baccarelli et al. 2008). Mocarelli et al. (2008) reported an association between compromised sperm characteristics (i.e., reduced sperm concentration, reduced sperm motility) and serum TCDD levels in men who were between the ages of 1 and 9 years at the time of the Seveso chemical accident, an event that resulted in widespread dioxin exposure among the Seveso population. Likewise, Baccarelli et al. (2008) studied the effects of TCDD on the Seveso population, in this case regarding the impact of maternal dioxin exposures at the time of the event on congenital hypothyroidism (CH) in neonatal offspring conceived later in life (as indicated by increased levels of blood thyroid stimulating hormone [TSH]). The RfDs derived from both studies by the USEPA were similar, so they considered them to be co-principal studies, and therefore identified male reproductive effects and increased TSH levels in neonates to be "co-critical effects." There are several significant flaws in both studies, and in how the USEPA interpreted the data for their RfD calculation including:

Mocarelli et al. (2008)

- The 1976 Seveso exposure incident involved an acute, high-level exposure that is not similar to exposures experienced on the Passaic River and at other environmental sites. This difference likely renders the RfD inapposite for use in chronic, low-dose exposure situations.

- Region 2 identified reduced sperm concentration in the Seveso men exposed as boys as the critical endpoint, and identified a lowest observed adverse effects level (LOAEL). However, none of the subjectively selected exposure groups had measured sperm concentrations that fell below the WHO clinical level of concern. In the absence of an actual effect, as well as the absence of a statistically observable dose-response relationship, the LOAEL identified by Region 2 to derive the RfD for TCDD is not useful for risk assessment because it is not based on a statistically significant adverse health effect. Additionally, because there is no response, the number should have been classified as a no observed adverse effects level (NOAEL); therefore, the uncertainty factor applied in the derivation of the RfD for the LOAEL to NOAEL is not warranted.

- The study authors did not present information on the geographic origins of the control group. Several studies to date have demonstrated that sperm counts can vary dramatically from city to city and among different geographic regions. For example, Fisch et al. (1996) conducted a literature review of geographical sperm concentration data and reported a high degree of variability within the United States. Mean values reported by the authors ranged from 52.9 million/ml in Iowa to 134 million/ml in New York, the former value being equivalent to that reported by Mocarelli et al. (2008) for the exposed 1 to 9 year olds from the Seveso cohort.

- Because of the small population size (n=71 for exposed 1 to 9 year old males), the study lacked the evidence necessary to conclude that TCDD exposure in young males affects semen quality, and thus male fertility.

- The association of serum TCDD levels in exposed 1 to 9 year old boys and serum quality was investigated without accounting for the other PCDD/Fs or DL-PCBs.

Baccarelli et al. (2008)

- The authors employed a clinically irrelevant screening level for CH: infant b-TSH levels were compared with a neonate TSH screening level recommended by the WHO in the early 1990s (5 microunits per milliliter [µU/ml]). This benchmark was not developed for CH screening, but for iodine deficiency disease (IDD). A more clinically relevant and commonly used b-TSH screening value specific to CH is 10 µU/ml (Corbetta et al. 2009). This level was not exceeded by any of the 51 Seveso neonates in the study's matched mother-infant pair analysis upon which Region 2 relied to identify a LOAEL for RfD derivation. Because there was no clinical evidence of CH in this study group, the analysis failed to support CH as a "critical" endpoint, and thus should not serve as the basis for a TCDD RfD.

- As with the Mocarelli et al. (2008) study, it is unclear how the effects reported by Baccarelli et al. (2008) in a population that experienced acute TCDD exposures translate to the general population. In fact, several other studies have shown that background dioxin exposures are not associated with neonatal hypothyroidism. Both Giacomini et al. (2006) and Goodman et al. (2010) reviewed prior studies that examined this possible association and found there was no consistent evidence that supported a relationship between low-level exposure to dioxins and neonatal thyroid hormone dysfunction.

- Even though Baccarelli et al. (2008) presented total TEQ data, Region 2 did not account for serum total TEQ when deriving their RfD, which (like the RfD-based on Mocarelli et al. [2008]) resulted in an overly conservative RfD value.

All of the above suggest that the RfD likely employed by Region 2 for TCDD is not appropriate and overestimates human non-cancer risks associated with ingestion of fish and crabs from the Passaic River. Such overestimation of human non-cancer risks can have a significant impact on the appropriate remedy selection. It is important to note that the WHO has developed an allowable daily intake for TCDD that is over three times larger than that utilized by USEPA (JECFA, 2001) for non-cancer effects. Use of the WHO allowable daily intake for TCDD in the FFS risk assessment process would lead to a 3-fold reduction in TCDD non-cancer hazard estimates. Incorporating site specific fish ingestion rates (see Section 2.5 below) which are at least 10-times lower than that likely utilized by Region 2 would lead to an overall non-cancer hazard that is approximately 30 times lower than that likely calculated by Region 2 in the FFS. This would call into the question the need for an early remedy such as that contemplated in the FFS.

2.4 Region 2 CSF Shortcomings

Region 2 also indicated in their updated LPR FFS that excess cancer risks to individuals were "substantially greater" than 10^{-4} (one in ten thousand) based on fish and crab ingestion, and that PCDD/Fs and PCBs were the primary drivers of this risk. It is likely that Region 2 employed the current USEPA or the California Environmental Protection Agency (CalEPA) CSF to calculate risks associated with PCDD/Fs (and potentially DL-PCBs) for the LPR FFS HHRA.

However, there are several shortcomings of these CSF values which lead to Region 2 overestimating the cancer risk posed by PCDD/Fs. The primary shortcoming is with regard to the dose-response model applied. Both the current USEPA TCDD CSF and the CalEPA CSF were derived using a linear extrapolation approach based on the presence of hepatocellular carcinomas and adenomas identified on pathology slides from a chronic rat toxicity assay conducted by Dow Chemical (Kociba et al. 1978; USEPA 1985). The use of a linear dose-response model assumes that the chemical has a mutagenic mode of action. This is clearly unsuitable for TCDD, as the bulk of the scientific community agrees that its mode of action is non-mutagenic (NTP 2011). Use of the proper non-mutagenic mode of action would result in the use of different risk assessment methods to evaluate the risk posed by TCDD. These different methods will dramatically change the estimated cancer risk posed by TCDD and would impact the decision process regarding the need for an early and extremely expansive remedy.

2.5 Region 2 Did Not Use Site-specific Exposure Parameters and Assumptions

The FFS Summary identified PCDD/Fs and PCBs as the primary contributors to both the excess cancer risk and non-cancer health hazard based on ingestion of LPR fish and crab. Although the details of the most recent Region 2 risk assessment have yet to be made public, it is likely that a select few specific issues are responsible for what are likely significant overestimates of human health risk.

It is expected that Region 2 used overly conservative default and/or non-site-specific values for key exposure parameters in their risk assessment rather than values informed by site-specific data, despite USEPA's own risk assessment guidance, which states that default values for exposure parameters should generally be avoided when local data are available (USEPA 1989). As is well known by Region 2, there is a wealth of site-specific data for this site including fish ingestion rates, exposure duration data, and other specific parameters. For example, Ray et al. (2007) published the results of a year-long creel angler survey (CAS) of angling activity and consumption patterns in the lower 6-mile stretch of the LPR. These findings demonstrated that the LPR angling population was best characterized as recreational (as opposed to subsistence) and that the overwhelming majority of the angling population did not consume their LPR catch. The fish ingestion rates from the CAS are 1.8 grams per day (g/day) for the 95th percentile of the angling population (Ray et al. 2007). These estimates are more than an order of magnitude lower than typical default rates of 26 grams per day. Although an independent panel of experts was commissioned to evaluate both the need for such a study as well as the adequacy of the CAS design for characterizing fish consumption endpoints (Finley et al. 2003), Region 2 raised concerns over the design and interpretation of the CAS' results. Currently, a follow-up CAS is being conducted for the entire 17.4-mile LPR study area. As with the 2000-01 CAS, Region 2 raised concerns over the current CAS' usefulness for informing the analysis of baseline risk in a HHRA (i.e., the risks that exist if no remedial action or institutional controls are applied to a site; National Contingency Plan 55 FR 8711).

Fish consumption advisories are considered a form of institutional control (USEPA 2010b). Because institutional controls can reduce or preclude exposure while not actively remediating a site, USEPA considers that their presence does not represent the baseline risk situation. In an April 14, 2011 letter to the CPG, Region 2 clarified its position on this issue by expressing the concern that, because of the current presence of the fish consumption advisory, a CAS conducted on the LPR study area will "…yield highly uncertain results and not accurately characterize exposure to the Reasonably Maximally Exposed individual." With Region 2's baseline risk concerns in mind, the work plan for the 2011-2012 CAS underwent extensive review by an independent expert peer review panel. The expert panel provided survey design and analysis recommendations that address Region 2's concerns about the study's usefulness for informing the analysis of baseline risk in a HHRA. The panel's survey design and analysis recommendations will make the subsequent analysis the most relevant and state-of-the art, site-specific tool for evaluating baseline cancer and non-cancer health risks from fish ingestion. For the FFS, it is expected, however, that USEPA used either national default fish ingestion rates (e.g., 26 g/day from the 1997 Exposure Factors Handbook), or a rate derived from an unpublished study conducted by Region 2 staff from angler surveys performed in the northeastern United States. Based on information available about this unpublished study, none of the studies used were performed in urban locations with limited access similar to that of the Passaic River. Clearly, Region 2 should use the wealth of site-specific CAS information available when evaluating health risks posed by fish ingestion.

2.6 Region 2 Did Not Evaluate All Relevant Routes of Exposure

It is likely that Region 2 only assessed human consumption of fish and crab and excluded other routes of exposure. Consequently, Region 2 is likely not accounting for risk posed by other chemicals via other routes of exposure. For example, waders and boaters are assumed to come into direct contact with LPR sediment, which is well known to contain high levels of PAHs and metals, in addition to PCBs and PCDD/Fs. It is expected that cancer and non-cancer risks associated with these exposure scenarios have been inadequately accounted for (or ignored altogether) in the Region 2 risk assessment. Importantly, USEPA guidance notes the following:

> "The classes of contaminants that are most common in sediment contamination are pesticides, PCBs, PAHs, and to a lesser extent dissolved phase chlorinated hydrocarbons. With the right geochemical conditions heavy metals and metalloids can also occur in sediments or precipitate into them" (USEPA 2012a)

Thus, given this USEPA guidance about the classes of chemicals to be concerned about at sediment sites, it is unclear why Region 2 is ignoring entire classes of compounds in the FFS.

2.7 Impact of Risk on a Small Exposed Population

The actual population for which the risk estimates were derived (LPR recreational anglers) is relatively small. A site-specific CAS of the lower 6 miles of the LPR estimated the annual angling population to consist of no more than 385 individuals (Ray et al. 2007). This is not surprising given the nature of the LPR region (tidal estuary that is highly industrialized and urbanized with limited access for anglers). Again, Region 2 does not provide a specific risk estimate for excess cancers among LPR anglers, only stating that the estimate was "substantially greater" than 10^{-4}. Even if we were to assume that Region 2 estimated excess cancer risks to be as high as 10^{-3} (one in one thousand), the estimated risk for this exposed population would still be less than 1 (0.385). Put another way, less than one excess cancer case would be expected in this population due to LPR fish and crab ingestion, an excess cancer risk impossible to discern from background lifetime cancer rates in the U.S. for the general population (30 to 40 percent; Urban et al. 2009). This calls into question the human health benefit of the proposed, very costly remedy.

2.8 Lack of Acute Risk and Recent Peer-reviewed Study on Current Risk Associated with LPR Fish Ingestion

It is important to note that there are no immediate (acute) effects associated with exposures to the COCs (PCDD/Fs, PCBs, PAHs and Hg) in LPR environmental media. The only acute effects associated with exposures to these compounds are due to extremely high levels – levels that are significantly above those associated with potential exposures estimated for LPR fish ingestion. As such, individuals that ingest fish from the LPR will not develop chloracne or any other discernible toxic response – the dose of a chemical of concern from ingesting a fish filet will simply be too small to elicit such effects. In fact, the estimated PCDD/F dose received from ingesting a fish from the LPR is substantially smaller than the PCDD/F dose received by a human infant that breastfeeds (Urban et al., 2009). Rather, the concern about the COCs in the LPR is chronic exposure over many years – and as shown by Urban et al. (2009), chronic human health risks were estimated to be close to the USEPA acceptable risk range in their site-specific fish ingestion risk assessment for the LPR. Because of a lack of acute toxicity by the COCs, the estimated PCDD/F dose from ingesting LPR fish being smaller than that received by a nursing infant, and the chronic risk and hazard being acceptable or close to acceptable, it is unnecessary to conduct a premature remedial action like that contemplated in the FFS.

2.9 Risk Assessment Methodology, Selection of Remedy Locations and Impact of Risk-based Remedies on Future Risk

Region 2 should have conducted the HHRA using probabilistic risk assessment (PRA) techniques (USEPA, 2001). Given the size and complexity of the LPR project and the potential remedial cost, it is expected that Region 2 would conduct a state-of-the-art HHRA. A state-of-the-art HHRA would include a PRA. The PRA would identify chemicals for which cancer risk estimates are greater than 10^{-4} and hazard indices are greater than 1 (COCs). Following USEPA guidance (USEPA, 2001), Region 2 should have performed iterative truncation with its PRA model to identify acceptable sediment concentrations for the COCs. The LPR should have been divided into sediment units using an acceptable statistical technique (Thiessen polygons for example), and concentrations of COCs in each sediment unit compared to the acceptable COC levels using iterative truncation. Where there is a COC exceedance, that sediment unit is targeted for remediation. In cases where only one COC is found to exceed an acceptable concentration in a sediment unit, remediation of that sediment unit is only attributed to that COC. In cases where multiple COCs are present at concentrations above acceptable levels, then the remediation attribution for that sediment unit is divided equally among those COCs. An important concept with this approach is that the absolute value of a cancer risk or hazard index is not important – once a chemical is found to be above the acceptable cancer risk or hazard index, it is designated a COC, and as such is solely or partially responsible for the remedial activities prescribed for that sediment unit within the site area. Additionally, this approach leads to a site-wide risk that achieves a 10^{-4} cancer risk and hazard index of 1 (USEPA, 2001).

It is expected that the Region 2 HHRA considered future risk, but it is unclear whether the remedial alternatives being put forth by Region 2 based on its HHRA are predicted to result in acceptable risk levels in fish and crabs in the future. This was a shortcoming of the 2007 Region 2 Draft Early Action FFS, in that future risk was evaluated for the LPR based on the remediation alternatives, but risks still exceeded the acceptable dioxin concentration in fish and crabs at the conclusion of various proposed remedies. Current institutional controls minimize the potential human health hazard. If acceptable human health risks cannot be achieved with the proposed remedy and at a cost exceeding $3 billion, then it should appear obvious that other solutions, which will be thoroughly evaluated in the 17-mile RI/FS, should be considered to reduce the long-term human health risk.

2.10 Region 2 Has Not Accounted for Other Dioxin-like Compounds at this Site

Recent sampling near an upland site known to be a source of TCDD (to which Region 2 has issued a General Notice Letter to a PRP for potential liability in the Newark Bay Complex) not only confirmed the presence of TCDD, but preliminary analytical results also indicate that TCDD accounted for no greater than 22 percent of the Total Biological TEQ in all five samples and as little as 9 percent in two of the samples. This evidence brings to light myriad complexities when evaluating remedial decisions, including but not limited to: (1) the existence of additional and potentially ongoing sources of dioxin and dioxin-like COCs that have not been thoroughly evaluated, and (2) contributions to Total Biological TEQ can be greatly impacted by other dioxin-like COCs (e.g., PCBs, PAHs, polybrominated diphenyl ethers [PBDEs], polychlorinated naphthalenes [PCNs], polybrominated biphenyls [PBBs], polybrominated dibenzodioxins/dibenzofurans [PBDD/Fs], polyhalogenated dibenzodioxins/dibenzofurans [PxDD/Fs], and other constituents) which are often not analyzed for or considered in risk evaluations.

3. Ecological Risk Assessment

3.1 Factors that Constrain the Ecosystem Functions of the Lower Passaic River

The LPR watershed is highly urbanized, has received inputs of industrial and municipal wastes, and has been subjected to myriad chemical and biological stressors since the mid-19th century. The LPRSA has also been subject to a wide variety of physical changes and stressors since the time of colonization, resulting in deleterious effects on the overall ecological "health" of the River. These historical changes have resulted in widespread habitat and biodiversity losses, the accumulation of chemicals in river sediment and biota, and impacts on water and habitat quality, the cumulative effects of which have substantially degraded the River's ecosystem and severely limited its potential use by humans (CPG 2009; Iannuzzi et al. 2002). The incremental risks of chemicals to the environment under these circumstances need to be considered in the context of the urban conditions of this system.

The ecological risk assessment performed for the FFS does not realistically or credibly consider the relative risk of chemical contaminants in this urban system, most of which would remain at present levels following implementation of the FFS remedy. The simplified screening-level approach to calculating hazard quotients on a chemical-by-chemical basis using very conservative, literature-based toxicological thresholds to represent actual risks to floral/faunal populations from chemicals in the LPR system is inadequate for supporting high-cost risk management decisions.

The NRRB should consider that an alternate ecological risk assessment for the LPR published by Ludwig and Iannuzzi (2005) exists in the peer-reviewed scientific literature. This risk assessment, performed using the same USEPA framework and methodologies as the FFS risk assessment, suggests that the incremental risks from chemical contaminants in this system are far lower than those reported in the FFS. The fact that two risk assessments, performed under the same USEPA framework/guidance, generate very different results regarding ecological risk highlights the need for a much more thorough and credible risk management process than has been developed to date under the FFS.

3.2 Background Conditions Will Result in Re-contamination of the Ecosystem

Because the primary focus of the FFS is historically contaminated sediment within the LPR, potential ongoing sources of chemical contaminants and environmental stressors from surface water and associated suspended solids currently entering the tidal portion of the River need to be considered in terms of both their current and post-remedy impact to the ecosystem. These sources include: (1) the watershed above Dundee Dam; (2) tributaries to the LPR; (3) CSOs/SWOs, and point source discharges (including SWOs); and (4) tidal inputs from Newark Bay. Given that the surface sediment of the lower 8 miles of the river will likely be re-contaminated to present levels by these internal/external sources following remediation, per the FFS, it is clear that background issues have not been fully or credibly factored into the decision-making process. As stated in the general comments above, the ecological risks of chemical contaminants posed by these sources are similar in magnitude to those from presently in-place surface sediment in the LPR.

3.3 Impact of Risk-based Remedies on the Ecosystem

The FFS does not adequately consider or weigh the relative ecological risks/impacts that would be created by the remedy itself, versus the low level of ecological/chemical risk reduction that might or might not be achieved. The FFS risk assessment is assumed to have considered future risk, but it is unclear whether the remedial alternatives being put forth by Region 2 based on its risk assessment are predicted to result in acceptable ecological risk levels in the future, nor does it define what those acceptable risk levels are. This assessment needs to be performed and clearly presented for consideration in the remedial decision-making for the LPR.

4. Site Background and Sediment Contamination

In general, the information presented in the FFS Summary on site background and sediment contamination accurately describes the LPR with respect to the site and the industrialized history of the region. However, the same document neglected to describe CSO/SWO and non-point sources, and historical sources of contaminants from the Upper Passaic River. A discussion regarding 80 Lister Ave. and the history of contamination is presented, yet none of the other "over 100 responsible parties" are highlighted or described. Further, there was no indication of the LPR Phase I Removal Action to describe the ongoing efforts to control and remediate the site. It should be recognized that the LPR Phase I Removal Action of the contaminated material along the River at 80-120 Lister Avenue, representing the area of the highest concentration of TCDD, took place last year.

Region 2 should develop a table that describes all facilities and associated contamination sources that affect the LPR. In addition, Region 2 should incorporate a detailed history of the shoreline development in addition to the dredging history. Historical modifications to both the river channel and the shoreline have had considerable impact to the river hydrodynamics. Over time, these changes have influenced sediment transport and environmental impacts to the River. As a result, a snapshot of current conditions will not be sufficient to understand why particular contaminants have come to be located at various points in the Passaic River system. Therefore, without a detailed history of shoreline development and dredging history it is difficult to fully characterize the pathways that led to the current contamination of the Passaic and thoroughly evaluate potential remedial actions. If it is necessary to specify the parties, information regarding any remediation work that has been recently performed must also be included.

5. Datasets Used in the RI

A comprehensive list of the studies/datasets that were used in the FFS must be included, as it is crucial to clearly lay out which datasets were used for the various analyses.

Page 3 of the FFS Summary states: "The RI evaluated data from numerous investigations conducted in the Lower Passaic River and Newark Bay from 1990 to 2011 by academic institutions, state and federal agencies (including USACE and New Jersey Department of Transportation data collected for the comprehensive Lower Passaic River Restoration Project), and potentially responsible parties under USEPA oversight, such as the CPG and Occidental. The investigations include sediment chemistry, hydrodynamics, sediment transport, bathymetry, geophysical and geotechnical surveys, water column chemistry, and ecological studies (benthic surveys, fish and crab tissue chemistry, habitat identification and avian community surveys)." Review of the data presented as part of the FFS Summary only indicate data used as recently as 2008, not, as indicated, back as far as 1990. Either the document should clarify which data and sources were used for each specific analysis, or the text should be modified to accurately reflect which years of data were incorporated. Similarly, later in the document, there is a reference to the analysis of Be-7-bearing sediment and no indication of which radiochemical dataset(s) were used to compile this assessment. Consequently, it was virtually impossible to verify any of the results.

5.1 Incomplete Data for the RI

As mentioned previously in the General Comments, data collection for the Passaic River and Newark Bay RIs is still ongoing and incomplete. Specifically, data are still being collected to characterize Newark Bay sediment erosion. In addition, prior sediment erosion testing in the LPR in 2005 produced highly questionable results. SEDFlume experiments (for Newark Bay) by Region 2's contractor began in October 2012 and are expected to be completed in November. Following the experiments, data packages and reports will be prepared, and a draft report is anticipated in January 2013. It is possible that these results will highlight the uncertainty associated with the LPR erosion data, requiring an evaluation of the need for additional SEDFlume testing in the LPR. It is critical to include data sets such as these, or remedy development and selection will not be based on a comprehensive and accurate understanding of the river system. For instance, the SEDFlume results may show that sections of the Lower 8 miles may be candidates for MNR or EMNR. The fact that the datasets for the FFS Study Area are incomplete again reinforces the premature nature of the FFS.

5.2 Methodology for Data Use should be Presented and Described

Region 2 is requiring that correction factors be applied to dioxin and furan sediment data from the LPR Low Resolution Coring (LRC) Program. Application of the mandated correction factors to the dioxin/furan sediment data will result in an upward mathematical adjustment of laboratory measured concentrations by as much as a factor of two in some cases. To our knowledge, USEPA has never before required the mathematical adjustment of an analytical dataset, and there is no precedence or guidance for how such an adjustment should be determined. Further and more specifically, there is no guidance available that would indicate that comparison of split sample results for a chemical or group of chemicals could or should result in application of a correction factor to a laboratory-generated dataset. The application of correction factors to this dataset is arbitrary and unwarranted due to the following factors:

- The dioxin and furan analytical data were judged to be biased low based only on the fact that the concentrations measured in split samples analyzed by Region 2's laboratory (AXYS Analytical Services), which represent only 30 of the more than 600 samples collected and analyzed during the LPR LRC Program, were on average greater than those of the CPG's laboratory (Columbia Analytical Services). The CPG's laboratory followed the standard operating procedure approved by Region 2 for use in this program as part of the LPR LRC Quality Assurance Project Plan (QAPP) when analyzing the samples; therefore, there is no justification for assuming that the data were invalid.

- Correction factors were developed for 14 dioxin/furan congeners using paired data from less than 30 split samples, and as few as 3 pairs were used in the calculation of correction factors, making them highly uncertain.

- Other analytical data (PAHs, PCBs) collected during this program were shown to be similarly “biased low” when compared to the Region 2 split sample data as described in reports by both Region 2’s and Tierra’s consultants. Yet, it was never suggested by Region 2 that these data be similarly corrected.
- Region 2’s arbitrary and inconsistent decision to require the adjustment of measured dioxin concentrations calls the scientific justification for the FFS into question, and could well support a conclusion that the FFS as a whole is arbitrary and capricious. This is particularly so due to the likely importance of dioxin concentrations to Region 2’s risk assessment. Region 2’s required adjustment of analytical results for dioxin alters laboratory results that fully complied with the RI/FS QAPP, and for which no errors in the procedures used were ever demonstrated, to make those results more closely conform the data to Region 2’s preexisting assumptions about what those data should be and to be more supportive of Region 2’s perspective that early action is required.

5.3 Data Collected from the LPR Phase I Removal Action Work Area Need to be Excluded from the Evaluations

The FFS should also account for remedial activities along the River. The LPR Phase I Removal Action removed a significant area of contamination; accordingly, the historical sediment data from this location should be removed from analyses (figures and statistical summaries), as contamination that has been removed is no longer germane to risk management decisions.

6. Nature and Extent of Contamination

The nature and extent of contamination in the LPRSA has not been adequately assessed. For instance, the FFS Summary presents an overly simplistic and misleading description of estuarine salt wedge and Estuarine Turbidity Maximum (ETM) processes. This flawed understanding, if used in remedial decision making, would lead to remedial alternatives that inadequately address source control by way of focusing only on sediment dredging in the lower 8 miles of the LPR and neglecting ongoing sources and post-remedy impact from sediment upstream from the FFS Study Area.

Page 4 of the FFS Summary states: “During low flow conditions, the salt wedge and ETM reach as far upstream as approximately RM 12, while during storm events, they may be pushed out to Newark Bay. Under typical flow conditions, the salt wedge and ETM are usually located between RM2 and RM10, and move back and forth along about 4 miles of the river each tidal cycle (twice a day). The movement of the salt wedge and ETM mixes the surface sediment, so that, while there is a broad range of concentration values (more than an order of magnitude), there is little or no trend in COPC and COPEC median concentrations with river mile in RM2 to RM12 (Figures 4-3, 4-12, 4-17b, 4-32b, 4-47b).”

The description of salt wedge and ETM on Page 4, while true in a very broad sense, neglects to describe that the salt wedge and ETM rarely reach as far upstream as RM 12. The assertion in the Summary that “During low flow conditions, the salt wedge and ETM reach as far upstream as approximately RM 12” does not appear to be based on observations but rather on modeling analysis, which has not been completed. Furthermore, the movement of the salt wedge and ETM is bi-directional, and favors the downstream direction and mixing of surface sediment in the FFS Study Area with sediment from RMs 8 and above.

Under typical flow conditions, the salt wedge and ETM are usually located below RM 6 and increasingly infrequent further upstream or downstream. The location and locational frequency of occurrence of the salt wedge and ETM in the LPR are understood through empirical data and curve-fitting mathematical analysis. Water column samples collected by Region 2 and CPG provide data on salinity and suspended solids concentrations, the U.S. Geological Survey (USGS) gage at Little Falls provides data on daily flow, and mathematical analysis uses these data to derive a relationship. Analysis of the CPG water column data and USGS flow data shows that the ETM is typically (more than 50 percent of time) below RM 6, and reaches RM 10.2 less than 1 percent of the time.

The location and locational frequency of occurrence of the salt wedge and ETM are not the only processes affecting sediment chemical concentrations. There is more sediment from upstream areas and tributaries moving in the downstream direction that mix with the sediment in the FFS Study Area than there is FFS Study Area sediment moving upstream. The ETM moves upstream and downstream in a tidally driven cycle. This means that the ETM moves in the upstream direction for a period of time (i.e., flood tide), and then reverses direction towards the downstream direction for a period of time (i.e., ebb tide). The amount of time associated with the downstream direction is greater than that associated with the upstream direction (i.e., tidal asymmetry), which is consistent with the observations that the LPR feeds into Newark Bay in a positive direction for both freshwater and sediment.

To accurately characterize how the ETM impacts surface sediment concentrations, it is important to adequately analyze and describe the mechanisms influencing the settling and resuspension of the sediment in the ETM. The mechanism is a function of bed shear stresses during both flood and ebb tides, the settling velocities, and the degree of consolidation of recently deposited sediment.

The salt wedge discussion was the FFS Summary's basis for using median sediment concentration values as a measure of the overall conditions. The median value is not recommended for these purposes; using a median in a highly skewed population that is possibly undergoing mixing can be a highly misleading statistical parameter. The sediment conditions and exposure are better represented by the mean concentration rather than a median concentration in a population. Furthermore, the median values depicted as horizontal lines in Figures 4-4 to 4-53 of the FFS Summary are medians over large (RM 1 to 7 and RM 8 to 17) stretches of the LPR, and the comparison of these lines is not a valid statistical comparison.

The nature and extent of contamination should be developed using sediment core chemistry profiles along with a map of the locations to strengthen the discussion on the vertical contamination as well as the horizontal contamination across the site. This presentation would also lead to identifying trends in river geomorphology.

7. Contaminant Fate and Transport

This section specifically examines the contaminant fate and transport evaluation presented in the FFS Summary.

7.1 Contributions of Contaminants are Crudely Estimated

The FFS remedial alternatives which favor dredging sediment from the FFS Study Area and trivialize other contaminant sources are supported by the conclusion, stated on Pages 1 and 7, that sources other than "resuspension of legacy sediments in the main stem of the FFS Study Area" are not significant contributors. This conclusion is based on the EMB model described on Page 7 of the FFS Summary, which estimates percentage contribution of solids and contaminants from various sources to the LPR sediment.

The estimated values from the EMB model are based on an incomplete list of sources, solids loadings estimated from these sources, and average or median contaminant concentrations in the suspended solids and surface sediment. The FFS Summary overstates the validity of these crudely estimated contributions and does not acknowledge the uncertainties and limitations of the estimates. For example, the analysis depends on identifying "recently-deposited" sediment based on Be-7. While the presence of Be-7 indicates recently deposited sediment, the lack of detected Be-7 does not mean that sediment was not deposited recently.

7.2 The EMB Model Is Not a Useful Tool for Understanding the Nature of Contamination and Proper Remedy Design

The FFS Study Area encompasses the lower 8 miles of the LPR, but the EMB model includes as a source the lower 17.4 miles of the Passaic River in its entirety. This approach is flawed. Solids and contaminant loading from RMs 8 through 17.4 need to be identified by the EMB model as a separate source into the FFS Study Area in order to properly describe the nature of contamination and remedy design for the FFS Study Area. Furthermore, the EMB model is based on current information that uses data from 2005 to 2011. The current conditions in the EMB model are not related to future conditions of sediment and contaminant loadings to the FFS Study Area, and therefore cannot properly assess the effectiveness of the remediation alternatives.

7.3 The FFS Summary Understates the Contribution from the Upper Passaic River

The FFS Summary stated on Pages 1 and 7 that sources other than "…resuspension of legacy sediments in the main stem of the FFS Study Area…" which includes the Upper Passaic River (i.e., above Dundee Dam), are not significant contributors. The estimated contributions (table shown in Page 7 of the FFS Summary) from the Upper Passaic River of solids, chlordane, benzo(a)pyrene, and fluoranthene to the FFS Study Area at 32, 32, 53, and 47 percent, respectively, are significant.

7.4 The Estimated Contributions are Inconsistent with Statements that Surface Sediment Concentrations are Unchanged over Time

Based on the table mentioned on Page 7 of the Summary, the contribution of solids from the Upper Passaic River, Newark Bay, tributaries, and CSOs/SWOs is a significant fraction (approximately 52 percent) of the total solids discharged to the LPR. If these are relatively "cleaner" solids than those from the FFS Study Area, then the areas of deposition in the FFS Study Area would become less contaminated over time.

7.5 The EMB Model Excludes Loadings from Non-point Surface Runoff and from Shoreline (Bank) Erosion

The FFS Summary does not include solids and contaminant loadings from non-point sources due to surface runoff or loadings from shoreline (bank) erosion. These sources may contribute a significant fraction of solids, so excluding them results in an incomplete and therefore erroneous representation of the solids mass balance.

7.6 The EMB Model also Excluded Sources such as Atmospheric Deposition, Groundwater Discharge, and Industrial Point Sources.

The contaminant fate and transport discussion states that "… the results of Region 2's analyses show that, currently, atmospheric deposition, groundwater discharge, and industrial point sources are not significant contributors of sediment and the contaminants bound to them." However, there have been multiple sites reported by Region 2 along the Passaic River shore and inland undergoing groundwater cleanup/remediation with "complex groundwater systems" that may have potential hydrogeologic connection either via direct groundwater discharge or via runoff/stormwater connectivity with the River. A mass balance model should include all sources. It is unclear whether the FFS Summary's conclusion, that these sources are "insignificant," is based on the EMB model or a separate analysis.

8. Sediment and Contaminant Transport Mechanistic Modeling

Specific comments related to the Sediment and Contaminant Transport Mechanistic Modeling section are provided below. Generally, the Region 2 mechanistic model is incomplete and the FFS Summary provided no evidence that the results of the Region 2 mechanistic model are consistent with the EMB model or a parallel mechanistic model being developed by the CPG. Technical credence for the proposed remedial alternatives, is therefore, not evident.

8.1 Lack of Results from the Mechanistic Model

The FFS Summary described the components of the mechanistic model but provided no results from the sediment and contaminant transport mechanistic model; therefore, the technical basis for the proposed remedial alternatives is not evident.

8.2 Lack of Evidence of Consistency between Models

The FFS Summary provided no comparison between the mechanistic model and EMB model to support its conclusion that the two models are consistent. The mechanistic model represents the state-of-science so that the level of consistency between the mechanistic model and EMB model shows whether the EMB model accurately estimated the contributions of solids and contaminants from various sources. The FFS Summary did not indicate how the two models are compared and their degree of consistency; therefore, the technical basis for this conclusion is not evident.

8.3 Integrity of Mechanistic Model

The conclusions from the superior mechanistic model should be based on its own findings and should not be based on conclusions from the cruder EMB model. The conclusions from the mechanistic model as described in the FFS Summary appear to be borrowed from the EMB model, which is inadequate for designing and evaluating remedial alternatives.

8.4 No Mention of Parallel Model

The FFS Summary should state that a mechanistic model is being developed in parallel by the CPG. The CPG, with oversight from Region 2, is currently developing an LPR-NB mechanistic model in parallel with Region 2's mechanistic model. The degree of consistency between these two highly sophisticated models by Region 2 and CPG is unknown. Inconsistency between the Region 2 and CPG models in describing contaminant transport and projecting remedy effectiveness could lead to significant doubts about whether the selected alternative can achieve the desired risk management objectives and is cost-effective.

8.5 Incomplete Mechanistic Model

The FFS Summary should state that the Region 2 mechanistic model is incomplete. As described in detail in General Comment 3, there is little evidence that this model is completed. The FFS Summary does not describe whether the model was calibrated and verified for each of the model components (hydrodynamic, sediment transport, organic carbon and contaminant transport and fate, and bioaccumulation), what the calibration parameters were, what model-data comparisons were made to verify model performance. Further, there is no evidence that an uncertainty analysis was performed that can support an evaluation and discussion of model uncertainty. These are key steps in model development to ensure that the model can accurately describe the hydrodynamic, sediment transport, organic carbon cycling, and contaminant fate and transport processes in the LPR and Newark Bay. These are also important in ensuring that the model will accurately predict the effectiveness of the proposed remedial alternatives.

The FFS Summary assumes that, in the mechanistic model, the Newark Bay portion of the model is fully functional and integrated with the LPR portion of the model, but the supporting data are still being collected.

SEDFlume experiments are currently being conducted in order to characterize the erodibility of sediment in Newark Bay. Without this information, it is not possible to model the resuspension of bed sediment in Newark Bay resulting from the combined action of wind wave- and current-induced shear stresses. Subsequently, the flux of sediment from the Newark Bay to LPR cannot be computed. The current model suite described in the FFS Summary, therefore, is not fully functional and cannot realistically analyze any remediation scenario, nor can it be compared with the predictions from the EMB model.

The uncertain status of Region 2's mechanistic model is reflected by the lack of results or supporting information in the FFS Summary. The model's last known status also raises the question of what basis was used to develop the proposed remedial alternatives.

8.6 Exclusion of Discussion of Hydrodynamic Conditions in the Newark Bay Area

Also of concern are the changing hydrodynamic conditions in the Newark Bay area. The Harbor Deepening Project has significantly changed the depths of the channels in southern and central Newark Bay, and these hydraulic changes should be incorporated into the model, particularly considering the movement of the salt wedge with the new hydrodynamics in the system.

9. Remedial Action Objectives

The Remedial Action Objectives (RAOs) stated in the FFS Summary are not specific to the lower 8-mile study area. Because of their broad language and overarching objectives, the achievement of these RAOs, as written, is highly dependent on a number of factors beyond the boundaries of the FFS study area. Region 2 appears to be seeking an ecosystem-wide solution, but their approach to the lower 8 miles will not produce such a result. As described throughout these comments (General Comments 1.3, 2.1, 2.4; Specific Comments 2.9, 3.2, 3.3), many factors contribute to reducing human health and ecological risk within the FFS study area. Such factors may not be successfully controlled through implementation of a remedy within the FFS study area alone, particularly if the remedy is not implemented in an appropriate sequence with other remedial activities in the lower 17-mile study area.

The RAOs cannot be considered without taking upstream sources into account because they have not been adequately characterized or controlled. Upstream sources will continue to contribute to the concentrations of constituents of potential concern (COPCs) and constituents of potential ecological concern (COPECs) within the lower 8-mile study area. As discussed further in the Remedial Alternatives section of these comments, the remedial alternatives must also be developed consistent with these RAOs. Migration of COPC and COPEC-contaminated river sediment may actually be increased through widespread dredging of the site. This would conflict directly with the third RAO, which directs to reduce such contaminated sediment.

The RAO section in the FFS Summary discusses how, in accordance with Superfund guidance, reasonably anticipated future land and waterway use should be considered during the development of remedial alternatives and in remedy selection. It goes on to describe the unmaintained, authorized navigation channel within the FFS study area, and the consideration that future maintenance of this channel should receive in the development of remedial alternatives.

The basis for maintaining the channel to its authorized depth throughout the FFS study area is not supported. A number of factors beyond maintained depth contribute to the limitations of the Lower Passaic River as a commercial navigation channel, including, most importantly, lack of demand due to changed commercial use of the river, vertical clearance limitations due to overhead structures, turning radius limitations due to river and bridge opening width, and competition from more viable berths within the local area.

As a result of Hurricane Katrina, a number of studies have been conducted on the Mississippi River Gulf Outlet in Louisiana to determine whether deep-draft navigation channels increase the effects of storm surge during hurricanes (USACE 2006; van Heerden et al. 2006). A number of site-specific factors play into these studies and models, including the presence of large marsh areas in Louisiana and the size of the storm surge. However, at a minimum, modeling should be conducted for any alternative that restores the navigation channel to its full depth throughout the FFS study area to determine what the potential impacts from storm surge due to hurricanes could be on the river system and flood levels.

10. Preliminary Remediation Goals

Very little information is provided in the FFS Summary regarding the development of preliminary remediation goals (PRGs). The FFS Summary notes that "background" concentrations coming over Dundee Dam are being considered in development of PRGs, citing USEPA guidance related to the cleanup objectives of the CERCLA program, stating "… the CERCLA program, generally, does not clean up to concentrations below natural or anthropogenic background levels." This statement implies that concentrations upstream of Dundee Dam should be considered background and accounted for in the PRGs.

However, as stated previously in these comments, Region 2's contractor, HydroQual, indicated in the CARP model report (HydroQual 2007) that sediment below Dundee Dam will be re-contaminated with TCDD and other contaminants because of a potential upstream source, suggesting that the concentrations are not background, but have the potential to re-contaminate any implemented remedy and cause failure to meet PRGs. Additionally, the FFS Summary describes mechanistic modeling conducted for the four remedial alternatives to determine whether post-remedial sediment chemistry concentrations are protective of human health and the environment. If PRGs have not been fully developed, it is unclear to what the results of the modeling are being compared to make such a determination.

11. Remedial Alternatives

The remedial alternatives described in the FFS Summary are presumptuous and may not be adequately targeting the actual risk drivers. It is apparent that sparse data and general lack of understanding of the dynamics at work in the lower 8-mile study area of the LPR, as discussed in previous sections, have resulted in incomplete development of alternatives. Four alternatives are described in the FFS Summary, but in actuality, only two alternatives (site-wide dredging and site-wide capping) are being presented for screening and evaluation against the nine CERCLA criteria. Lessons learned from previously implemented sediment remedies have demonstrated that single-technology alternatives are not effective at sites this large and complex (NRC, 2007). On page 16 of the FFS Summary, it states that Alternative 4 (Focused Capping with Dredging for Flooding) was screened out based on modeling projections that showed it would not result in post-remedial sediment concentrations that are protective of human health and the environment. The conclusion from this seems to be that any focused or targeted remedy proposal will not meet remediation goals and that only Region 2's full bank dredging and/or capping will. The lack of a viable multi-technology alternative that targets specific areas with applicable technologies reveals that there is insufficient site knowledge to formulate such an alternative. As stated in the USACE 4 Rs report, "…. the effectiveness of any remedial technology, including dredging, is most appropriately measured through a comparison of what could be achieved through use of an alternative technology… It would be consistent with such a principle to start a remediation project by implementing less invasive and costly remedies that can be more easily modified, or even undone, if the desired risk reduction trajectory is not being met. This logic would lead to giving consideration to MNR before capping and capping before dredging, rather than the reverse." (Bridges et al. 2008).

Remedial alternatives that rely primarily on dredging to achieve risk-based goals have demonstrated limitations as a result of the effects of sediment resuspension and residuals (Bridges et al. 2010), and the timeframes for reaching acceptable risk levels at the site may span decades. These considerations must be accounted for in the development and evaluation of the alternatives. When a Feasibility Study is performed, each potential alternative must have a remedy- specific risk assessment to determine to what extent levels of risk will be reduced and/or <u>how long it will take to reach remediation goals.</u> Many sediment sites can reach targeted risk levels if given enough time via MNR or EMNR. The agency recognizes the use of MNR as a legitimate alternative for Superfund sites, especially where remediation costs are extremely high.

For instance, in the Draft Portland Harbor FS, the projected site-wide changes in surface sediment concentrations of select COCs during and following implementation of each comprehensive alternative was modeled. This analysis showed that the alternatives that included more environmental dredging/removal were projected to result in higher overall surface sediment concentrations over substantial periods of time (i.e., approximately 10 to 30 years during construction) compared to the integrated alternatives with more emphasis on EMNR/in-situ treatment and capping due to the effects of dredge residuals (LWG 2012). Therefore, projection of the time to reach acceptable risk levels at the site must account for this effect. The recent National Research Council (NRC) report discusses this concept in detail:

"At the largest sites, the time frames and scales are in many ways unprecedented. Given that remedies are estimated to take years or decades to implement and even longer to achieve cleanup goals, there is the potential—indeed almost a certainty—that there will be a need for changes, whether in response to new knowledge about site conditions, to changes in site conditions from extreme storms or flooding, or to advances in technology (such as improved dredge or cap design or in situ treatments). Regulators and others will need to adapt continually to evolving conditions and environmental responses that cannot be foreseen." (NRC 2007)

If many sediment remedies (even no further action) can result in achievement of remediation goals given enough time, the decision maker needs to balance the cost of different alternative remedies against the time it will take to achieve such goals. As there are no hard and fast rules governing how much time is too long to wait to achieve remediation goals, it becomes a judgment of the decision maker to decide how much money is too much to reduce the time it takes to meet remediation goals.

The issue that must be considered is, is it good public policy to require the expenditure of $1 billion - $3.4 billion for the deep dredging or capping remedies to achieve remediation goals if it takes "x" years, when perhaps a much less costly MNR or EMNR remedy will only take "y" years longer? By refusing to include Alternative 4 in its detailed analysis, the NRRB, Agency decision makers, and the public are excluded from understanding and commenting on this very analysis.

11.1 Effectiveness

The FFS Summary provides a brief description of the mechanistic modeling conducted to evaluate future contaminant concentrations in sediment post-remediation. However, it is unclear that the model accounts for the short-term effectiveness of any of the proposed alternatives, and specifically, the anticipated impacts from dredging. Achievement of PRGs will be affected by resuspension, release, residuals, and risk (the 4 Rs) from dredging. The results of a number of environmental dredging projects have shown that these four factors affect the ability of environmental dredging to achieve risk-based goals

MNR is mentioned as a component of all of the remedial alternatives, but it is not being used as a remedial technology to assist in meeting PRGs. MNR consists of allowing natural processes to reduce sediment concentrations to below remedial goals in areas where other remedial technologies have not been applied. In the FFS alternatives, what is described as MNR is actually the standard monitoring activities required as a part of gauging the success of any remedy. EMNR, consisting of broadcasting coarse-grained material over surface sediment, is not mentioned or included in any of the alternatives. Based on the CSM and mechanisms for sediment movement described in the FFS Summary, EMNR is likely well suited to this site. Alternatives that include MNR or EMNR in combination with areas of capping and dredging to address the highest inventory of COCs should be evaluated. This is consistent with USEPA guidance, which states, "Due to the limited number of cleanup methods available for contaminated sediment, generally, project managers should evaluate each of the three potential remedy approaches (sediment removal, capping, and MNR) at every sediment site. At large or complex sites, project managers have found that alternatives that combine a variety of approaches are frequently cost effective" (USEPA 2005).

The sequencing of remedial implementations within the 17-Mile LPRSA is another factor in remedy effectiveness. Similar to the upstream-to-downstream construction sequence proposed for the lower 8-mile section, the overall

17-mile site should be sequenced to address upstream contributions to each section prior to remedy implementation within that section, resulting in the following sequence: (1) sediment above Dundee Dam, (2) CSOs/SWOs, (3) upper 9-mile section in conjunction with tributaries, (4) lower 8-mile section.

11.2 Implementability

There are a number of challenges to the implementation of a large-scale dredging remedy that could have substantial impacts on project cost and schedule, none of which are mentioned in the FFS Summary. Environmental dredging can be difficult to implement effectively. Projects must be carefully planned to avoid the risk of resuspension and recontamination from the dredging activity. Tierra's experience with the LPR Phase I Removal Action demonstrates that the presence of debris in the Passaic can be a significant complicating factor that introduces delay in the implementation of a dredging remedy. In addition, a dredging remedy on the scale contemplated by the FFS raises serious questions about the disposal of dredged material. Dredged material management scenarios B and C presented in the FFS require upland disposal of the dredged sediment. Given the vast scope of the contemplated dredging remedy, it is not clear that upland disposal can be effectively implemented. Thus, dredging of the scale considered in the FFS will almost certainly require the use of a CAD or CDF.

11.2.1 Dredging Is Difficult

Dredging should be considered in any sediment remediation project. The reality, however, is that dredging is a difficult, expensive, and often ineffective way to reduce risk and meet PRGs. Dredging must be employed only where mass removal can result in significant reduction in risk. This is not to suggest that dredging would not be a component of any remedy for the lower 8-mile site, but that it must be used as a technology of last resort in targeted areas when other technologies have been exhausted and demonstrated to not be effective in meeting PRGs. The complexity of a dredging project of the magnitude described in the FFS Summary is unprecedented and significantly understated in the document.

Although there is a long description of dredging on page 11 of the FFS Summary, there is only brief mention of the logistics of working around existing structures and bulkheads that is focused on the impacts to the dredging production rate in these areas. A waterfront structural survey was conducted along the shoreline of the Phase I and Phase II Work Areas as a part of the LPR Phase I Removal Action design (Tierra, 2009). The results of the survey showed that bulkheads and floodwalls were in variable condition, and concluded that precautionary steps would need to be taken during removal activities to maintain structural integrity. Even in areas of shallow dredging along the mudflats, the removal of passive pressures against failing shoreline structures will require significant bulkhead improvements to ensure structural stability. Design, permitting, and construction of these types of improvements have impacts to cost and schedule, and it is unclear whether they have been considered.

11.2.2 Debris Is a Reality

A highly urbanized river such as the Passaic with a long industrial history will have significant quantities of debris of all sizes entrained in its sediment, as was demonstrated during the LPR Phase I Removal Action. Despite conducting pre-design investigations targeted at identifying concentrations of subsurface debris that could delay or complicate dredging operations, a layer of concentrated debris was encountered that significantly slowed both the dredging and sediment processing operations. Another example of large debris is the CPG's analysis of the 2008 bathymetric survey data, in which 15 submerged automobiles within the lower ~8 miles of the river were used to validate the correction of the bathymetric record.

11.2.3 More Material Means More Space and More Community Impacts

One of the more challenging aspects of dredging is handling the material once it has been dredged. In rural areas, where vacant land is plentiful, constructing the infrastructure necessary for handling millions of cubic yards of sediment may not be a primary project challenge. However, in a densely populated urban core, finding a suitable upland processing site with adequate river access; viable off-site transportation routes; and space for sediment processing, water treatment, material storage and transfer, and associated equipment that does not adversely impact the surrounding community is a significant challenge. Many potential upland sites were considered for the LPR Phase I Removal Action, though few of them were within the lower 8-mile site boundary, and eventually only one was truly viable. Before considering a dredging project of the magnitude proposed in the FFS Summary using Dredged Material Management (DMM) Scenarios B and C, which would require upland space, a short-list of viable upland processing sites should be developed.

The advantage of DMM Scenario A, disposal in a CAD cell, is that impacts to the local community can be significantly minimized and site controls are much more straightforward, as the work is confined to the river. Off-site disposal traffic is eliminated, which reduces risks from vehicular traffic, particulate emissions, greenhouse gas emissions, and chemical exposures to the community.

11.2.4 Sediment Throughput Rates, Not Dredging Production Rates, Are the Schedule Driver

The FFS Summary focuses much of the discussion regarding production rates on the anticipated dredging production rate based on the pilot study conducted in 2005. However, a number of factors contribute to the overall throughput of sediment from the point of dredging to the disposal of the material. The rate of sediment movement from point of origin to disposal is likely to vary significantly based on a variety of factors: the material type (e.g., coarse, fine, clay), debris type and quantity, differences in contamination (e.g., slowing production to reduce air, water, worker, and community impacts), river conditions, distance from offloading facility, offloading and off-site transportation capacity, and throughput capacity of the disposal facility. In addition, freezing temperatures, high winds, and storm events may cause additional delays. Operating a sediment processing and water treatment plant virtually year-round, as proposed for DMM Scenarios B and C, would require a significant investment in site infrastructure such as buildings and other temperature-regulation equipment. Considering all of these factors, the duration of the dredging project, and consequently, project costs, may be significantly longer and higher than estimated.

11.3 Costs

Very minimal information was provided regarding the basis for the cost estimates in the FFS Summary; however, based on a unit-cost comparison to other sediment mega-sites, it is likely that the costs for the proposed alternatives have been severely underestimated. Based on previously implemented projects of similar size and complexity, costs may have been underestimated by a factor of two, particularly for alternatives that include off-site treatment and disposal. It is also unclear whether the risks to cost and schedule, discussed in the previous sections, have been adequately factored into the cost estimates.

12. Mechanistic Modeling to Evaluate Alternatives

12.1 Incomplete Mechanistic Model

Region 2 and the CPG have both expended significant resources developing an LPR-NB mechanistic model because the mechanistic model is necessary for reliable remedy design and evaluation. The objective of a fully developed mechanistic model is to provide a reasonable representation of current and future conditions. Such a model is designed to incorporate the relevant hydrodynamic, sediment transport, organic carbon cycling, and contaminant fate and transport processes; hence, it is the most effective tool for investigating the remediation alternatives. Large contaminated sediment sites, such as the Hudson River and the Housatonic River, relied upon a site-specific mechanistic model to design and evaluate the effectiveness of alternatives. The alternatives for the LPR cannot be reliably developed or evaluated because the mechanistic model is incomplete.

12.2 Uncertain Consistency between Models

The objective of Region 2 and CPG is to develop a mechanistic model that reproduces the physico-chemical processes in the system and can be used to examine remedial alternatives that can be mutually verified. Without such a model, the verification and evaluation process will be complicated and inefficient. The level of consistency between the Region 2 and CPG mechanistic models is currently unknown.

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